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APPLICATION OF DYNAMO-ELECTRIC MACHINES TO TELEGRAPHY.

The telegraph, in its importance as a factor in commercial intercourse, in the wonderful rapidity of its development, and in the perfection of its details, rivals anything recorded in the annals of invention. Within the last decade not only have improvements been made which increase the capacity of land lines fourfold, but the cost of working has been greatly reduced. In 1873 the Western Union Telegraph Company sent 14,456,832 messages, at a cost of $6,575,055. In 1879 they sent 23,070,106 messages, at a cost of $6,160,200—considerably less than the first-named sum, while the number of messages sent was nearly double. In 1869 the cost of battery per mile of wire was 117 1-10 cents. By the adoption of improved forms of battery and by various other improvements, the Company has reduced this sum year by year until, in 1879, the cost of battery per mile of wire was only 34 1-10 cents, and now, although this is high economy, the present cost of supplying the electric current is to be reduced 50 per cent by dispensing with batteries and using electric machines.

There are at present on the top floor of the Western Union building 14,300 gravity battery elements, and in an adjoining building there are 4,600 bichromate of potash elements, all of which are to be replaced by electric machines, and the electric current will be generated by the consumption of coal instead of zinc and acid. It is not a new idea to use machines for this purpose, but experiments in this direction, until quite recently, have not proved entirely successful. The new system of current supply, which has been adopted by the Western Union Company, has for the last few months been thoroughly tested in San Francisco, to the satisfaction of telegraph engineers and operators, and recently a set of machines have been put on trial in the battery room of the Western Union Building with satisfactory results. The apparatus consists simply of a number of Siemens machines connected in series, and having their field magnets excited by a current supplied by a single Siemens dynamo-electric machine.

All efforts formerly made in this direction sought to accomplish the object by using a single high tension machine. The potential is now obtained by connecting one commutator brush of one machine with the brush of opposite polarity of the next, and so on, and a current of any desired potential may be had by taking it off from the different machines in the series. A current taken from the first machine in the series will have a low tension; that taken from the second machine will have a higher tension, and so on.

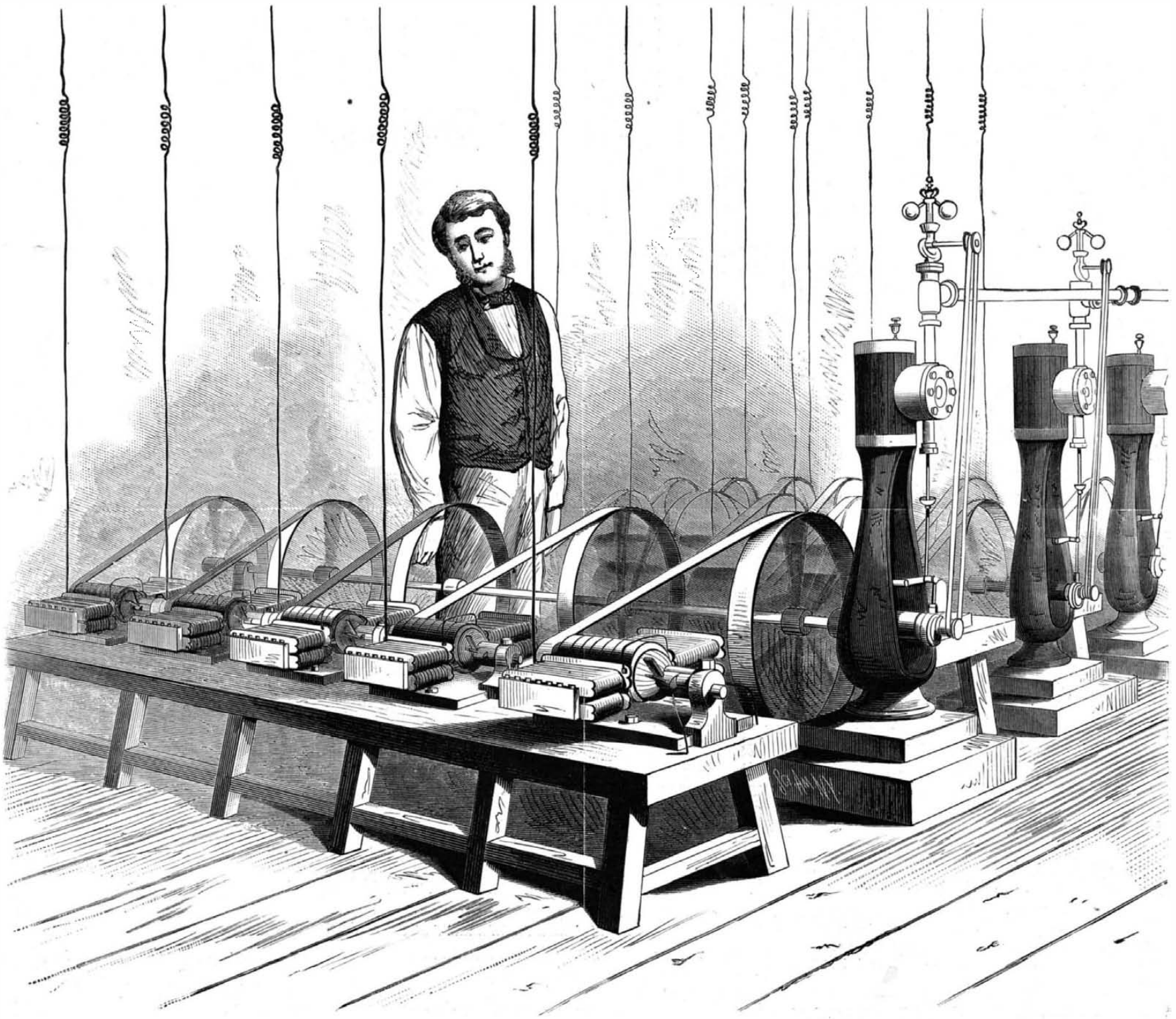
The electromotive force of the first machine in the series is 50 volts; in the second, 100 volts; in the third, 150 volts; in the fourth, 250 volts.

There are three sets of the machines and engines—two sets for working the 360 wires radiating from the Western Union Building, and the cables of the Gold and Stock Telegraph, and one for reserve. The current is equally well adapted to the quadruplex and to the printers of the Gold and Stock Telegraph. These machines and their engines will not occupy a tenth of the room now devoted to batteries, and a single engineer can attend them all.

When this system is thoroughly inaugurated, the batteries will all be removed, relieving the battery room floor of a weight of 60 tons, that being the difference between the weight of the batteries and that of the new plant. The current generated by the machines is to be used for all of the purposes for which battery power is now used, such as annunciators, call bells, small motors, etc., besides working the main lines and local circuits, and in addition to this the Western Union Building is to be illuminated by electricity at an early day.

The Siemens machine is preferred to any other. In its construction it is compact and simple.

The armature consists of a hollow soft iron cylinder provided with brass heads and mounted on the shaft carrying the driving pulley. Around this cylinder a few layers of iron wire are wound circumferentially, and over this are wound longitudinally the insulated wires forming the conductors. There are 56 strands of wire, each of which is



DYNAMO-ELECTRIC MACHINES APPLIED TO TELEGRAPHY.—WESTERN UNION BUILDING, NEW YORK CITY.

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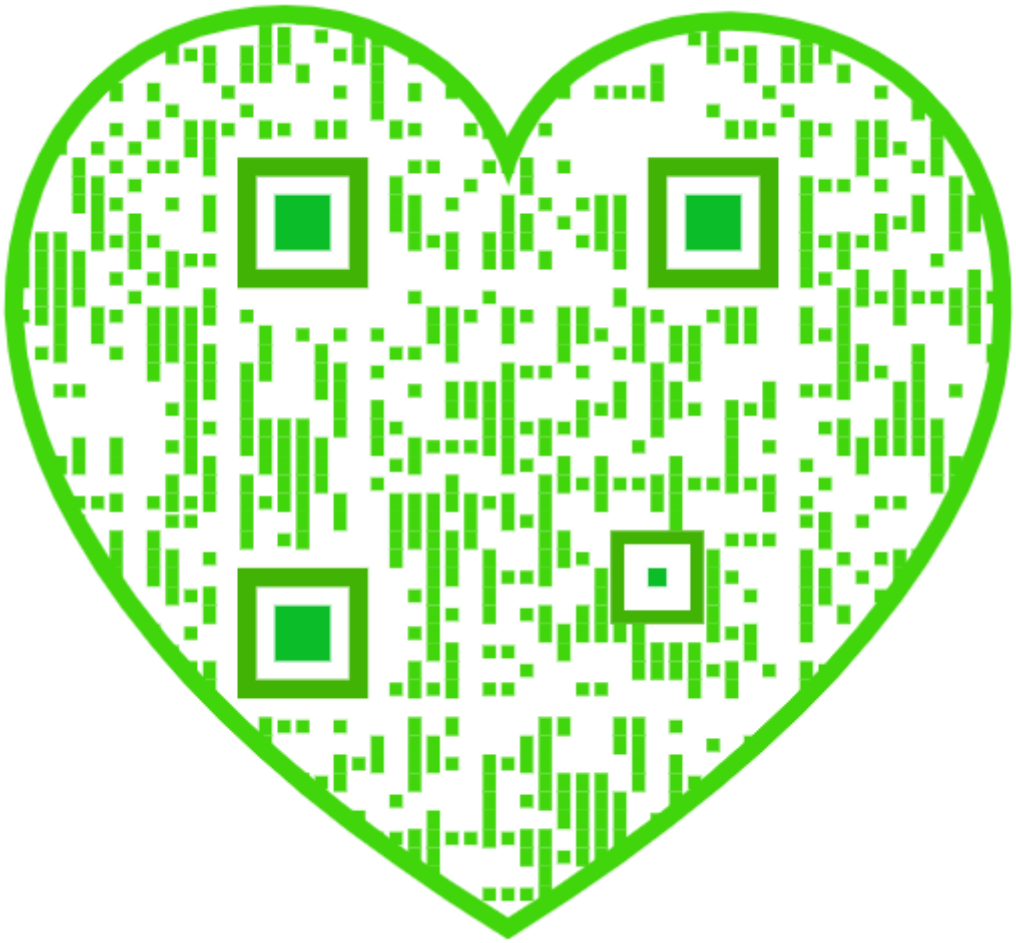

wrapped seven times around the iron core, having their termini soldered to bars on diametrically opposite sides of the commutator cylinder. The armature thus formed revolves between the poles of the field magnet, and its commutator cylinder is touched on opposite sides by brushes which take off the current. In the dynamo machine the armature and field magnets are in the same circuit. In the magneto machines which furnish the current to the lines the armatures are in the telegraphic circuit, while the wires of the field magnets are connected with the exciting dynamo.

The application of mechanical generators of electricity to telegraphy must be regarded as a great stride in the march of improvement, as it not only economizes space and means, but it supplies a known quantity in place of an unknown quantity. It replaces the subtile and variable acid and zinc, with the constant and positive power of steam. Without doubt the day is near when batteries will not be found in large telegraphic centers. They will probably be used in local circuits in small offices, but so far as working lines and large central offices are concerned there appears no reason why the machines should not speedily come into general use.

THE WORLD'S FAIR OF 1883.

A meeting to further the movement for a world's fair in this city in 1883, was held in Chickering Hall, January 14. A considerable number of capitalists and other influential gentlemen were present, and letters and telegrams of approval from many prominent statesmen, business men, and others, were read. Addresses were made by Hugh J. Jewett, President of the Erie R. R., Gen'l Joseph R. Hawley, of Connecticut, Senator Windom, of Minnesota, General Chas. E. Hooker, of Mississippi, and others. Considerable enthusiasm was manifest, but no positive action was taken further than to adopt a resolution asking Congress to take measures to give the proposed fair "official sanction and aid commensurate to its importance."

In the course of his remarks Gen'l Hawley said of our patent laws: 'They may not be perfect, but they have done more than anything else perhaps to stimulate the ingenuity of the nation. In all the manufactories, a mechanic knows that if he invents something to save time and labor he can get a patent for it and be protected. Of course in carrying out these inventions a great many are shipwrecked, but on the other hand a great many are victorious, and this protection to ingenuity is making us an inventive nation. Another reason is that we are not cursed by the worst features of trades-unionism, which enslaves and cramps the mechanic himself. The unions forbid him to make anything more than his own particular part, and keep down the number of apprentices. These features weigh down with all their force upon enterprise and ingenuity. But you cannot control a Yankee shop in that fashion. If there be an invention the mechanic will be protected, and a manufacturer will run it in his shop if it breaks up all the other places in the land."

ELECTRIC MACHINES IN TELEGRAPHY.

The new and remarkable departure in the art of telegraphy, which we this week chronicle, to wit, the substitution of dynamo machines in place of galvanic cells for generating the electric current, is due to the genius and perseverance of Mr. Stephen D. Field, of San Francisco, Cal.

Various efforts have been made during past years to do away with the cells and their concomitant troubles and expense. Many of the most eminent electricians have turned their attention to the problem, but one and all have heretofore failed to attain the coveted success. The account we give this week of the great change which is now going on within the walls of that great palace of electrity, the Western Union Telegraph Building, shows that Mr. Field's discovery is one of vast importance, for which he is entitled to most generous rewards. His invention has made a complete revolution in the economies of telegraphy, and before a twelvemonth closes it will doubtless be in general use throughout the world. We heartily congratulate Mr. Field upon his splendid achievement. It is one of those brilliant discoveries that is far-reaching in its results and confers a direct, lasting benefit upon mankind.

Good Times for Mechanics.

The Baldwin Locomotive Works are now employing over a thousand more workmen than a year ago, though the last year's work showed the largest production of any year except 1873, when 422 locomotives were built. During 1879 there were built 398, of which 84 were for export, going to Australia, Brazil, Cuba, Norway, Mexico, Guatemala, Peru, Sandwich Islands, and West Indies. The large number of large orders now in hand keep the force employed full time. In every other line of mechanical production the same evidences of prosperity are observable.

Manganese Bronze.

In Prussia there has recently been introduced a new alloy of manganese and copper, which promises to be of considerable importance. "Mangankupfer," as the new bronze is called, consists of 70 per cent of copper and 30 of manganese, and is employed in small quantities to improve common brass, bronze, bell-metal, and the like, rendering them, it is stated, more compact, hard, and ductile.

THE late Leonard Case, of Cleveland, left property valued at $1,500,000 for a school of Applied Science in that city.

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NEW YORK, SATURDAY, JANUARY 31, 1880.

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THE FUTURE OF ELECTRICITY.

Marvelous as have been the applications of electricity during recent years as a message bearer, light giver, health restorer, and otherwise, it requires no prophetic vision other than that which knowledge gives to foresee an extension of the uses of electricity in the immediate future infinitely beyond anything that the multitude now anticipate. The truth is, men have but barely begun to suspect the capacity of electricity to serve their kind. However numerous the means devised for harnessing the subtle power or great the social changes brought about by its employment, as in the telegraph and the telephone, the vast field for the application of electricity to human affairs has hardly been entered upon.

The best proof of this truth is seen in the varied lines of electric investigation and invention developed during the years just past, each with infinite possibilities, and all marked by surprising discoveries and practical utilizations at almost every step in advance. These lines of research point every way; and it is hard to name a direction of thought or a sphere of practical effort toward which, or into which, electrical investigation is not working or holding out promises of great reward to such as will enter boldly, intelligently, and perseveringly upon the quest.

Men of middle age have witnessed the more remarkable of the stages of social revolution which the utilization of steam has brought about during the past fifty years. Ten years ago it did not seem possible that any power could ever again enable men to repeat the giant strides of progress which steam, in our factories and on the highways of commerce, by sea and by land, had made possible. To-day even greater and more rapid revolutions are impending from the utilization of electricity, and men now living will probably see them brought about.

A few weeks ago we had occasion to speak of the great changes in social and business affairs already effected, and the greater in immediate prospect, through the development of the telephonic exchanges. In every important town such exchanges are in process of development, bringing into vocal communication not only the separate members of widely-extended communities, but also still more widely-separated communities.

Since then a novel and important improvement in a special field of telephonic use has been reported from London. Our readers are familiar with the principle of Mr. Edison's electromotograph or loud-speaking telephone. By employing his small electric motor to turn the chalk cylinder the telephone is made automatic. Instruments of this sort have been placed in, and a large number more are in preparation for, the London *Times* newspaper office; and the reporters of the paper, say in Parliament, instead of reading their shorthand notes to copyists, and transmitting the longhand copy to the printer, as heretofore, now read them directly to the telephone, thus saving the time of copying and carrying the report. In the printing office the compositor sits at a typesetting machine, and, as the report is delivered to him by the automotic telephone, he sets the type as one would play a tune upon a piano. Having no copy to decipher, his whole attention is given to the setting of the type, and another great saving of time is effected. The indications are that by the use of autographic and automatic telegraphy (in conjunction perhaps with stenographic typewriters) reports of public meetings will soon be almost instantly transmitted through long distances and at a fraction of expense which such work now involves. By the same process drawings as well as writings will be transmissible quickly and economically. Such inventions open up lines of progress too far reaching for the boldest imagination to follow.

In this issue of the SCIENTIFIC AMERICAN an account is given of an invention which, in quite a different direction, promises to work great changes in telegraphy. By substituting dynamo machines for batteries in developing the currents used in telegraphing, not only is a great economy effected in the working of the wires, but the larger part of the valuable space now occupied by the batteries is wholly saved. In the central building of the Western Union Telegraph Company in this city twelve tons of machinery take the place of seventy-two tons of battery cells.

The magnitude of the interests affected by an invention like this will be appreciated when we call to mind the fact that the Western Union Company alone requires something near 200,000 miles of wire for its connections in this country. The telegraph lines of all Europe will aggregate something like half a million miles. It must not be forgotten that for every mile of real wire employed in telegraphing the introduction of the quadruplex system gives three miles of "phantom" wire. In other words, the system makes every wire so used equivalent to four wires under the old system; and no one can say how far improvement in this direction is or is not possible.

The future of electricity in the sphere of light giving is daily becoming more apparent. The impossibilities of last year are the achievements of this year; and even if we were compelled to say that hitherto the electric light has not passed beyond the experimental stage, the positive gains made during the past few months are a guarantee that in several directions practical success is assured.

Our readers are already familiar with what Mr. Edison has accomplished. Many other more or less successful inventors are at work upon one or other of the various and very promising systems of electric lighting, both in this country and in Europe. In London a steady and remarkable progress is reported in the working of the Jablochkoff

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candles employed at the Victoria station of the Metropolitan Railway and on Waterloo Bridge. A 20 horse power engine already sustains 60 lights (of from 500 to 700 candle power), and 80 lights are promised when another couple of Gramme machines are put down. The length of cable used is upward of a mile and a half, the length of the circuit over three and a quarter miles. It is claimed that the limit of the power of the engine has not been approached. The light already furnished exceeds 1,500 wax candles to the horse power; and yet the margin for improvement is enormous. The actual energy of the coal used is not less than eight times that really developed as light.

In still another direction—the development of thermo-electricity by direct solar radiation, by the utilization of the waste heat of our fires, and the like—the possibilities are incalculable and the work of invention but scarcely begun. In the near future, too, men will draw upon many now neglected sources of power, which will give them through the mediation of electricity a greater supply of motive force than is now derived from all our coal mines. In a recent issue of the SCIENTIFIC AMERICAN SUPPLEMENT the progress made in the utilization of electricity as a carrier of power economically developed in large engines operated by steam power, waterfalls, and the like, was described at great length by Professor Ayrton.

The transmission of power by electricity both for short and for long distances, is not only practicable but economical; and the sanitary and other advantages of drawing power from a distance, for small manufacturing and for operating domestic machinery, are so enormous that the new system is sure to work great changes in all branches of industrial affairs. In every department of life this most nimble and willing servant of humanity is becoming useful, or rather men are beginning to discover how infinite is his capacity for usefulness and the marvelous economies possible throughout his employment. He is as ready to work for us as to run our errands, or watch our property against thieves and fire. And it is no stretch of imagination to say that our children if not ourselves will see the small steam engine everywhere displaced by the electric motor, which will convert into motive power the subtle energy conveyed by wires from central sources of energy—huge furnaces constructed on the most approved scientific principles, out of the way waterfalls, tidal currents, even the sun himself. And doubtless this cleanly and trusty servant will serve humanity in ways we do not dream of now, and at a cost that will be, by comparison with the present cost of light and heat and working energy, almost nominal.

TWO MORE PATENT BILLS.

Two bills to amend the patent laws were introduced in the House of Representatives, December 18, and numbered respectively 3,039 and 3,041.

The first, by Mr. Vance, of North Carolina, provides that any one of the joint owners of any patent for an invention may grant a license to use the invention, but not exclusively, except under the following conditions: (1) When the conveyance or other instrument creating the joint ownership (recorded in the Patent Office before the execution of the license) provides that no license shall be valid unless executed by all the owners, or a specified portion of them in number or interest; or (2) when the joint owners have previously made an agreement limiting the power of the individual owners to grant licenses, and have had the agreement recorded in the Patent Office. The bill further provides for the recording of such powers of attorney, agreements, and the like in the Patent Office, and the use of certified copies of such papers in evidence, as is now done in the case of records of assignments. So far as appears the proposed amendment seems likely to be beneficial.

Not so much can be said of the bill introduced by Mr. Young (H. R. 3,041). Hitherto the American patent laws have wisely regarded inventors as the only parties entitled to the protection guaranteed by letters patent. Mr. Young proposes to extend the protection to those who introduce inventions from foreign countries; but (apparently) only under the curious condition that the art or process to be patented shall have been "used or practiced, unpatented, for the period of fifty years last past exclusively in the country where obtained."

Possibly this is the very thin end of a wedge designed to open our Patent Office to the class of operators known in Europe as "patent sharks," who watch the records of the patent offices of other countries for promising inventions which they immediately proceed to patent as introducers—a sort of industrial piracy which has not been and we trust never will be encouraged in this country.

It is more probable, however, that the parties for whom Mr. Young is working are interested in some art established in a country where patents are not granted—an art which they wish to introduce and monopolize here, or, what is quite as likely, one which they wish to keep from being practiced among us. Under a law such as he proposes any distinctively Asiatic, African, Swiss, Turkish, or South American art, and a wide range of arts which have been practiced too long in either of the several countries of Europe which issue patents to have ever been brought under the action of patent laws, could be patented here, either to work or to suppress. The propriety of granting such great privileges for nothing, or worse than nothing, is not obvious, to say nothing of the probable lack of constitutional authority for such a departure from the principle on which our patent laws are based.

THE TAY BRIDGE DISASTER.

The mails bring no conclusive explanation of the terrible railway disaster at the Frith of Tay. The hypothesis suggested as the most probable, in view of the meager telegraphic account of the disaster—namely, that the bridge was bodily blown away—still seems the most probable. The only point cleared up by the divers is that both the bridge and the train fell together, and that the train had entered upon the fourth span from the south end of the gap before the bridge was overturned. The disaster occurred where the sides of the iron lattice girders rose above the level of the track.

The hypothesis of the constructing engineer of the bridge, Sir Thomas Bouch, is that when the train reached the fatal spot it was tilted over against the girders by a sudden gust of wind, the girders gave way under the strain, and the whole structure broke down under the combined impact of train and storm. This is the best face that can be put upon the terrible affair; not a few engineers, however, are of opinion that the extreme height and narrow base of that portion of the bridge afford a sufficient explanation of its inability to withstand the pressure of the gale. It is certain that the stability of the bridge under the stress of high wind has more than once been seriously questioned. It is even said—though the evidence is not conclusive—that a leading firm, to whom the contract for the construction of the bridge was first offered, declined to undertake it on the ground that a bridge on the plan contemplated could not be made secure. The policy which dictated a single track, and therefore a high and narrow bridge, for such a crossing, proves to have been terribly the reverse of economical.

THE PAST YEAR'S WORK IN THE PATENT OFFICE.

For the first time the year's work of the Patent Office shows a falling off, due undoubtedly to the attempt in Congress last winter to change the law to the injury of inventors. The determination expressed by inventors at the time to withhold applications for patents until assured that their rights would not be laid open to invasion by so doing, thus shows itself. The larger decrease in the number of patents issued may be due in part to the diminished means of the office through the reduction of the appropriations, which reduction, the Commissioner says, has been carried so far as to seriously cripple the office and injure the public interests. The completion and wide distribution of photolithographic copies of the drawings of American patents granted prior to November 20, 1866, and the distribution of English patents for reference in the Examiners' rooms, have aided to a considerable extent the Commissioner thinks, in reducing the number of patents issued.

The statistics of the office for the year ending June 30, 1879, are as follows:

The number of applications for patents was 19,300, being 357 less than the previous year. The number for design patents was 697; for reissue, 639; for registration of trade marks, 1,465; for registration of labels, 631; caveats filed, 2,674.

The number of patents granted, including reissues and designs, was 12,471, being 1,629 less than the previous year. The number of trade marks was 1,144; labels registered, 403; patents withheld for non-payment of final fee, 828.

The total receipts of the office were $703,146.79, being $31,741.19 less than those of the previous year.

The expenditures for the year were $548,651.47. This includes $5,000 appropriated for the repair of models damaged by the fire, and is not properly chargeable to the current expenses of the office.

The expenditures for the previous year were $665,906.02; $50,000 of this being for the repair of models. Excluding the amount appropriated for the repair of damaged models in both years, the current expenditures of the office were $72,254.55 less than those of the previous year. The excess of receipts over expenditures was $154,495.32.

This excess the Commissioner pronounces an unjust tax upon inventors, and favors its reduction either by exacting lower fees or by expending the surplus in improving the facilities for transacting the business of the office. He recommends the latter course. He calls attention to the inadequacy of the rooms provided for the use of the office, and, after insisting that the office needs and ought to have exclusive possession of the entire building, excepting the rooms of the Secretary of the Interior, he recommends that temporary accommodations be provided in that portion of the building now being reconstructed.

The Commissioner further asserts that the interest of the service demands an additional force of clerks and examiners, and to this end he recommends that provision be made by law for ten additional clerks of class one, three of class two, two of class three, one of class four, and fifteen assistant examiners. He suggests also that a portion of the surplus revenues of the office be used annually for the purpose of making additions to the technical library of the office, and for increasing the compensation of the clerks and employés, who, while forced to remain in the lower grade because of inadequate appropriations, are showing efficiency entitling them to higher pay.

Touching the present system of requiring and preserving models the Commissioner makes the pertinent remark that it cannot be permanent, and steps toward a change ought to be taken at once. At the present rate of accumulation there will be more than two million models to house before our second Centennial year, requiring fifty halls as spacious as those now used for storing models. In a few more centuries the entire Federal District would be inadequate to the storage of these evidences of American inventiveness. At the present time models are actually used in the examination of about 50 per cent of the cases in which models are filed. With proper scale drawings from working machines by far the larger part of the models now used might be dispensed with. The Commissioner, therefore, recommends as a first step toward getting rid of models that the following statutory provisions be enacted:

1. That no model shall be required or filed in any case, unless upon a written certificate filed in the case by the examiner in charge of the division to which the invention pertains that it will be useful in the examination of the application, or upon the special order of the Commissioner.

2. That the Commissioner shall not require the production of a model for the examination in any case in which the applicant shall furnish satisfactory scale drawings, made from a working machine, and shall produce for examination a working machine in operation in the city of Washington.

3. That upon the expiration of every patent the model pertaining thereto shall be sent by the Commissioner to one of the public institutions of science and art in the United States.

The only exception that can be taken to these recommendations is, perhaps, in connection with the third. The final disposition of the model might properly be left to the option of the inventor.

To obviate the risk of accidental or fraudulent alteration of models in the manufacture of copies of models for official certification, the Commissioner recommends the enactment of a law authorizing the employment for this purpose of skilled workmen, who shall take the oath of office and give bonds for the faithful performance of their duty.

The Commissioner further recommends that a law be passed authorizing the execution by United States commissioners, or other United States officers, of commissions issued by foreign governments to take testimony in the United States to be used before foreign patent offices and before all judicial, legislative, and executive departments of foreign governments, and to punish perjury committed in such testimony; the law to be operative only in favor of such governments as shall make like provision for taking testimony in foreign countries, to be used in like manner in the United States.

Also that the law relating to the payment of the final fee within six months of the allowance of a patent be so amended as to make the execution of the law possible in all cases. Under the present law, requiring a patent to be dated within six months of its allowance, the payment of the fee on the last day of the prescribed time makes it impossible to conform to the law without resorting to the fiction of a new allowance, made upon payment of the final fee too late to admit of the preparation of the patent before the expiration of the six months. The extension of the time, within which a patent may be dated, to seven months from the date of its allowance would obviate the present difficulty.

German Professors.

In the German universities the professors are men who have distinguished themselves by their contributions to science. They have usually begun their career as "privat docenten," or private teachers, a position unknown in America. If successful, they are made professors extraordinary, and of these a few only reach the distinction of professor ordinary. Any young man of promise, who has obtained the degree of doctor of philosophy (Ph. D)., with honors, can obtain permission to lecture in a given university, provided he passes a good examination in the subject that he intends to lecture on. The university gives him a room to lecture in, and if he succeeds in securing any listeners he gets their fees; beyond this he takes care of himself. His income depends entirely upon his popularity. If his lectures are good, and he proves his ability, his success is assured. In a few years he is called to a vacant chair in the same, or oftener in another, university, where he holds the position of extraordinary professor for years, often for life.

The following list of professors of chemistry in the principal German and Swiss universities embraces many distinguished men whose names are familiar in this country. The figures annexed give the ages of these men, and, as the *Journal of Applied Chemistry* says, they show that most of them are no longer "mere boys:" Berlin, A. W. Hofmann, *æt.* 61; Bonn, A. Kekulé, 50; Breslau, C. J. Loewig, 76; Erlangen, J. Volhard, 45; Giessen, H. Will, 67; Göttingen, F. Woehler, 79, H. Huebner, 42; Halle, W. Heintz, 62; Heidelberg, R. Bunsen, 67, H. Kopp, 62; Jena, G. A. Geuther, —; Königsberg, W. Lossen, 41; Leipsic, H. Kolbe, 61; Marburg, Th. Zincke, 39; Munich, A. Baeyer, 44; Strassburg, R. Fittig, 44; Tübingen, Lothar Meyer, 49; Würzburg, J. R. von Wagner, 57, J. Wislicenus, 44; Zürich, V. Merz, 42.

The oldest of these, Professor Woehler, no longer lectures. He will celebrate his eightieth birthday on the 31st of next July.

Dead at His Post.

A singular, but fortunately not a common, danger of travel was illustrated on the Fulton Ferry, between New York and Brooklyn the other day. A boat was in the slip on the Brooklyn side, and for a few minutes the deck-hands waited, wondering at the unusual delay in starting. Finally two of them mounted to the pilot-house and there found Wm. A. White, the pilot, on the floor, just dead. He had died of heart disease just as he was ready to sound the signal to start the engine. Had he fallen while the boat was in the middle of the crowded river, a very serious accident might have followed.

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NEW INVENTIONS.

Mr. Benjamin Houts, of Junction City, Kan., has patented improvements which relate to combined girder and suspension bridges, wherein the girders rest at both ends upon the abutments and are sustained between the ends by cables. The invention consists in combining girders and grooved abutments with cables, screw bolts having nuts and hooks, suspenders, braces, and stays.

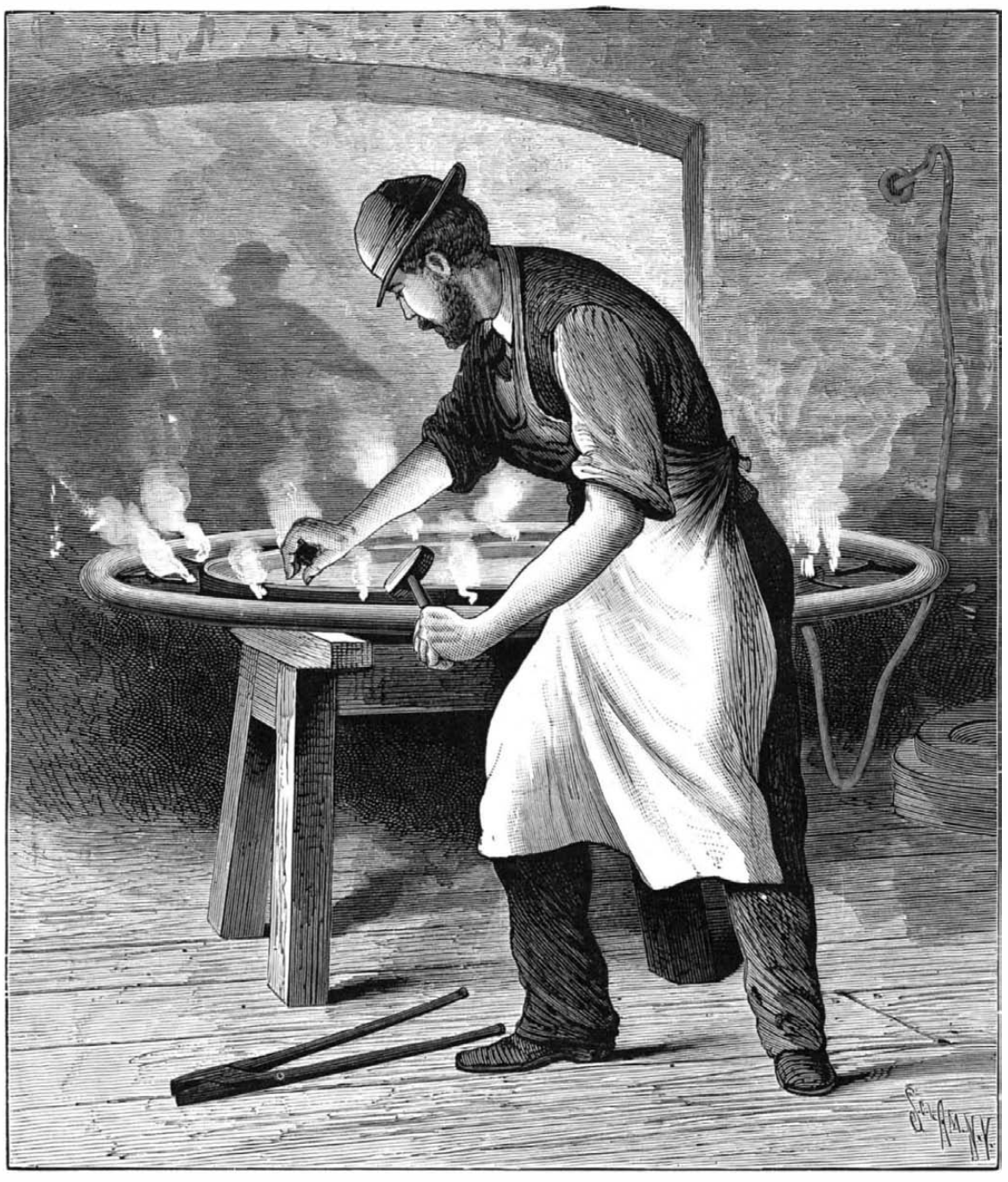
Mr. William J. Holman, of Fort Wayne, Ind., has patented an improved compound rail for railroad tracks. This invention relates to three-part rails so formed in passing through the manufacturing rolls that they will require no other device, appliance, or attachment to make perfectly secure rails than to place them together and spike them to the cross-ties.

HEATING TIRES BY GAS JETS.

Some time since we gave an illustrated description of the extensive carriage manufactory of Messrs. Brewster & Co., of this city, and in that establishment we find a simple piece of apparatus for heating carriage tires which we do not remember seeing elsewhere. Our engraving conveys a correct idea of the device, and it will require little description to make clear its construction and operation.

A ring of iron pipe is connected by a flexible tube with a gas supply pipe, and projecting from its inner surface there is a number of gas burners, which are articulated so that they may be moved to accommodate tires of different sizes. The tire to be heated is laid upon an iron frame inside the circular pipe, and the gas jets directed against the periphery of the tire. When the tire is sufficiently heated it is removed and set on the wheel in the usual way, another tire in the meantime having been placed within the circle of gas jets.

The efficiency of this device is proved by the fact that a single series of gas jets arranged in this way is sufficient to heat all of the tires which are set in this great establishment.



APPARATUS FOR HEATING TIRES.

Artesian Wells.

Mr. George H. Andrews, a member of the firm of Wm. D. Andrews & Bro., proprietors of the patent for the American tube or driven wells, says that there are over a million driven wells in the United States. In New York and Brooklyn there are over two thousand in leading hotels, factories, breweries, stables, marble-cutting establishments, etc., all of which are reported to us as giving satisfaction. Some idea of their actual value to their owners may be gained from the testimony recently given in court by the president of the New York Gaslight Company, that his corporation was saving $8,000 per annum by the use of the driven well; that he believed $10,000 to $12,000 would be within the mark, but as he wished to keep far within bounds he would say $8,000. Hecker & Brother save from $4,000 to $5,000 by its use in their large flouring mills. Smith's ale brewery gets 60,000 gallons per diem from driven wells; D. Jones' two breweries, 50,000 gallons; F. G. & I. N. Van Fleet, maltsters, of Newark, 75,000; Williamsburg Brewing Company, 30,000; Rubsam & Horrmann, 35,000; N. Leitz & Sons, 20,000; Otto Huber, 20,000; George Bechtel, 20,000; Gluck & Scharmann, 12,000; Myer & Bachman, 15,000—and all these amounts are obtained in only ten hours' pumping.

Some time since it was found necessary to increase and improve the water supply of Newark. Something less than one hundred of these driven wells were put down within an area of four acres, and from them 2,700,000 gallons of water per diem have, during the past six months, been poured into the reservoirs. This water is obtained at a temperature of 53°, is soft, and clear as a diamond. The Newark Aqueduct Board, on the evening of December 26, adopted a resolution setting forth that upon the most careful analysis this water was found to be of excellent quality, and had been of great advantage in improving the city's supply; that 250,000,000 gallons had been furnished by these wells in four months of dry weather without material diminution of the resources; that it was "indispensable to adopt some plan to avoid the dangers arising from the continued use of river water, and also to save the enormous cost of the works necessary to procure a supply from a distant source;" and finally, that it was "expedient and desirable to make arrangements to continue the driven well system on a larger scale," with a view to bringing it into full operation before next summer.

All that has been achieved in Newark is practicable in New York, and in the inexhaustible supply in the depths of the earth beneath our city lies the easiest solution of the problem so frequently recurring of late years, how to make the water supply here adequate to the increasing demands. The average cost of sinking a two inch tube well on Manhattan Island is about $300. That would yield, if required, six to eight thousand gallons of water in twenty-four hours. For a supply of Croton to that amount, by meter, the consumer would have to pay $360 to $480 per annum.

In driving a well at the Passaic Rolling Mills, Paterson, N. J., a remarkable bed of quicksand was lately struck at the depth of 1,180 feet. Mr. Watts Cooke gives in a recent issue of the *Paterson Press* a long and interesting account of the progress of the work. The first 565 feet was through red sandstone, then the drill passed through 44 feet of red shale; that was followed by 6 feet of red sandstone, 30 feet of red shale, and then red sandstone and shale in alternate beds from 6 to 12 feet thick, until the quicksand was struck. The quicksand appeared to be but a few inches thick. The intention is to sink the well from 2,000 to 2,500 feet.

The great artesian well at Buda Pesth, begun in 1868, is now reported finished. The total depth is 3,200 feet, and the temperature of the water is 165° Fah. The temperature of the mud brought up by the borer was taken every day, and was found to increase rapidly, in spite of the loss of heat during the ascent, down to a depth of 2,700 feet. Beyond this point the increase was not so marked. At a depth of 3,000 feet the temperature was 177°, giving an increase of 1° for every 23 feet bored. Water first began to well up at a depth of 3,070 feet, its temperature then being 110°. From this point onward the quantity and temperature of the water rapidly increased. Thus at 3,092 feet its temperature had risen to 150°, and the yield, in twenty-four hours, from 9,500 to 44,500 gallons. Finally, when the boring had reached 3,200 feet, at which point it was stopped, the temperature of the water as it burst from the orifice of the tube was 165°, and the quantity 272,000 gallons in the twenty-four hours. The yield was afterward reduced to 167,200 gallons, in consequence of the bore being lined with wooden tubes, which reduced its diameter.

Ignorance Regarding Machinery.

The general ignorance regarding machinery is surprising when it is considered that machines, in some form or another, enter so largely into the economies of our daily life. The Boston *Journal of Commerce* hinks that newspaper men are especially open to this charge of ignorance, which in their case is the less excusable, as they are expected to "know something about everything." When such mechanical appliances and chemical operations are combined, as in the experiments of Edison, perhaps a lack of definite knowledge may be overlooked; for only a comparatively few specialists are *au fait* on electricity, an agent but recently introduced into our every-day life. But the steam engine—its office and work, and its prominent parts—has been a common possession for generations, and the ordinary tools of the mechanic—the lathe, planer, screw-cutting machines, and other common appliances—are to be seen everywhere, and ought to be familiar to all. Yet the news paper notices of machinery and tools are seldom correct unless written by a practical mechanic, and sometimes are laughable from their absurdity. A short time ago, in a notice of the derailment of a locomotive by the breaking of a connecting bar between the drivers, it was stated that the piston rod broke, and the end, falling to the ground, lifted the engine from the track! Another account told of the breaking of "the crank of the truck." Latterly we had an account of the "explosion of a steamboat's chimney," and "explosions of engines" are frequently mentioned. One account of a boiler explosion that tore the boiler house and engine room to pieces, gave as a reason why the engine was comparatively uninjured that the engine was not running at the time! The bursting of a fly wheel by the breaking of the governor belt, which stopped it, and allowed the full pressure from the boiler to enter the cylinder unchecked, was accounted for by the too rapid velocity of the governor! The collapse of a flue was called the "bursting of the crown sheet," and the worst explosion of all was the "explosion of a rivet." A notice was recently made of the cracking of the walking beam of a large engine, and the statement was made that the works would stop until a new "shaft" could be cast. A notice of a new marine engine stated that the piston rod ran in ball-thrust bearings—alluding probably to the thrust bearing of the propeller shaft! A description of a large boring lathe conveyed the information that the live cone ran in "rabbeted boxes," meaning, evidently, that the live or head arbor ran in Babbitt metal boxes. A new planer was described as having "ways that run on V frames;" and a screw machine which made machine screws from bars was credited with "threading the heads of the screws," and that process was described as done *after* the screw was cut off the bar. "A solution of bicarbonate of soda" was employed on the screw-cutting tool.

These inaccuracies are in some cases inexcusable, but, in most, a superficial knowledge of a machine, or a smattering of natural philosophy found in common school text books, would have prevented errors so egregious as to raise the laugh of ridicule.

To Remove Nitrate of Silver Stains.

Dr. Kraetzer, of Leipsic, proposes, as a substitute for potassium cyanide in the removal of stains made by lunar caustic or silver nitrate, the following mixture: 10 grammes ammonium chloride, 10 grammes corrosive sublimate, dissolved in 100 grammes of distilled water, and preserved in a glass stoppered bottle. He says that with this solution the black stains may be removed from linen, woolen, and cotton goods perfectly without injury to the goods. It will also remove stains on the skin, but, although less poisonous than the cyanide, it must not be forgotten that it is a corrosive poison. For the skin we prefer to apply tincture of iodine, or a solution of iodine in iodide of potassium, followed by strong aqua ammonia; if slower it is safer both to use and to keep in the house.

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THE MANUFACTURE OF SODA.

Soda is now universally manufactured from chloride of sodium (common salt), which is first converted into sulphate of sodium, and is then treated with powdered chalk and coal. Leblanc has introduced the following proportions for this mixture: 100 parts sulphate of sodium, 104 parts of carbonate of calcium, and 39 parts of coals.

If in solution, the sulphide of calcium and the carbonate of sodium can remain without acting upon each other. The results of the operation are variable mixtures of carbonate of sodium, caustic soda, sulphate of calcium, and lime. As the proportions of the carbonate of calcium are varied, the results obtained vary more or less likewise, but generally the quantity of lime used is greater than the quantity given in the theoretical formulæ.

The process of making soda may be divided into four distinct successive stages:

1. The reduction of the sulphate of sodium into a sulphide $Na_3SO_4+2C=Na_2S+2CO_2$.

2. The double decomposition of the sulphide of sodium and the carbonate of calcium: $Na_2S+CaCO_3=Na_2CO_3+CaS$.

3. The production of oxide of sodium, due to the partial reduction of the excess of carbonate of calcium, by the coals: $2CaCO_3+2C=2CaO+4CO$. (The quicklime acts upon the carbonate of sodium during the lixiviation.)

4. The production of oxide of sodium, in case an excess of carbonate of calcium is not used, due to the action of the coal on the carbonate of sodium: $CO_3Na_2+C=2CO+Na_2O$.

It is evident that by varying the proportions of the coals and lime, more or less caustic salts and caustic soda may be obtained. The latter branch of industry has been greatly developed in England, particularly since the adoption of the rotating soda furnaces. In France, where the latter are used but very sparingly, the soda salts contain only from 2 to 10 per cent of caustic soda. The first rotating furnace was built in 1853, by Messrs. Elliot & Russel, and has since been considerably perfected by Messrs. Stevenson, Williamson & MacTear.

The furnace as it is generally constructed and as exhibited at the Universal Exhibition of 1878, in Paris, consists of an enormous cast iron cylinder lined with fire brick, and arranged to rotate on the longitudinal horizontal axis, as shown in Fig. 1 of the annexed engravings, which we have taken from *La Nature*. The flames of an adjoining furnace pass into the cylinder at one end and escape at the other, passing through and heating the mass contained in the same. The cylinder is provided with several openings for filling and discharging it. These openings are closed by means of cast plates furnished with locking devices. The revolving furnace does not require any stirring and mixing of the mass as is necessary in the reverberatory or ordinary soda furnace, and it permits of operating much more rapidly.

Both in the reverberatory and revolving furnaces the raw soda forms hard lumps, if the proportions of Leblanc, as given above, are adhered to, and these lumps can only be lixiviated with the greatest difficulty. Mr. MacTear avoided this difficulty by adding about five per cent of quicklime to the mass, thereby obtaining a product that could be very easily lixiviated, for the lime expands as it comes in contact with the water and breaks the lumps into small pieces. A factory in Glasgow, using MacTear's improved revolving furnace and the above improvements in the process, produces fifty tons of soda in twenty-four hours.

The lixiviation is carried on in the apparatus and according to the continuous method of James Shank, as shown in Fig. 2 of the annexed engravings. A and B are vats or tanks containing the lumps of raw soda, and are provided with perforated false bottoms; CC are pipes which convey the lye from one tank to the other; by this means it is gradually concentrated and the soda is gradually and thoroughly lixiviated. The lye is evaporated in furnaces, heated by a separate fire or by the waste heat of the soda furnace, until it has the consistency of sirup, which mass is then placed in large crystallizing vessels, subdivided by perforated plates, like sieves. The carbonate of sodium settles on the sieve plates, whereas the impurities are contained in the concentrated lye. In order to obtain the commercial product the carbonate of sodium must be calcined. Mr. Thelen has constructed an apparatus in which the lye is evaporated and the crystals are collected mechanically as rapidly as they are formed.

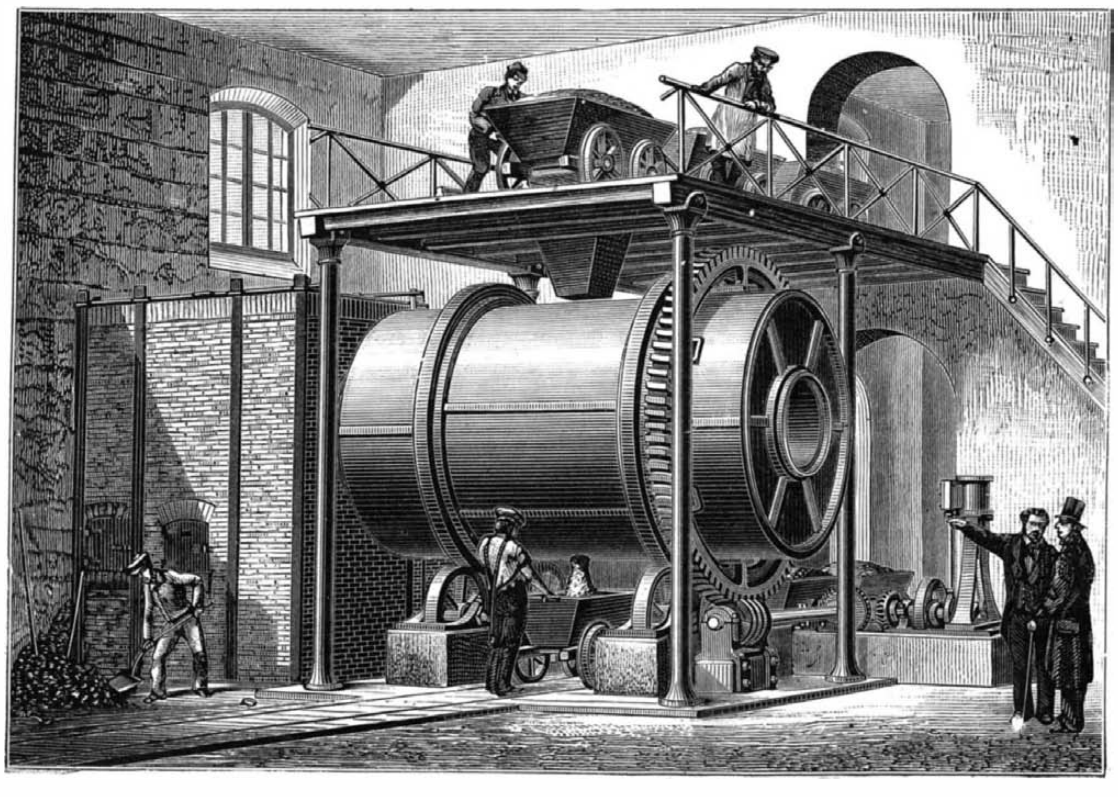


FIG. 1.—REVOLVING FURNACE FOR THE MANUFACTURE OF SODA.

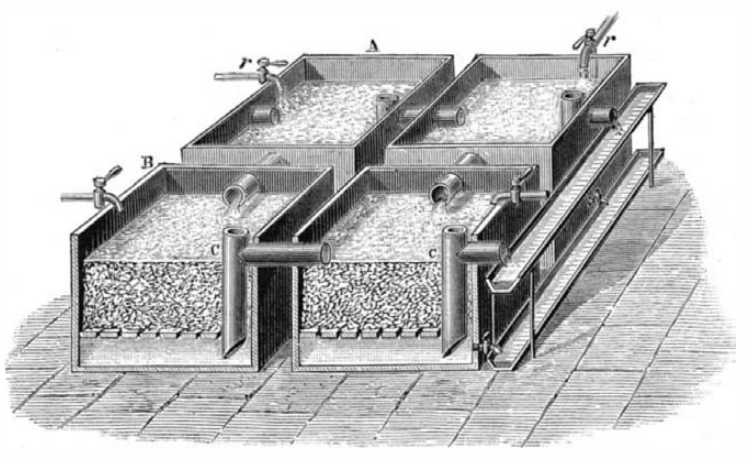
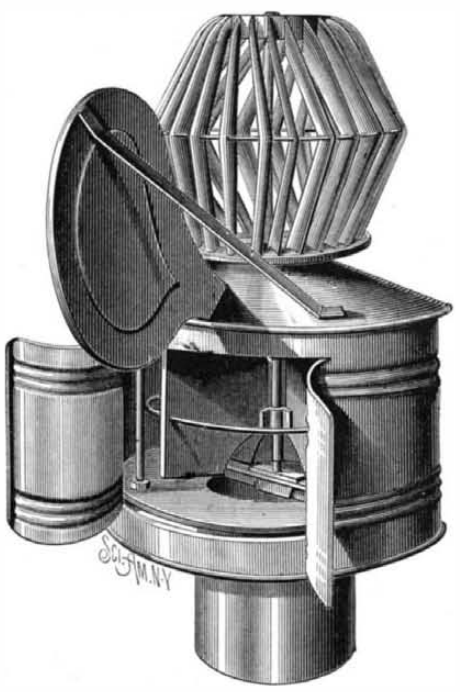


FIG. 2.—APPARATUS FOR LIXIVIATING SODA.

A NEW VENTILATOR.

In comparing the various methods of ventilation, Surgeon General John S. Billings, U. S. Army, who has made ventilation a life study, and other eminent authorities, agree as to the power, capacity, and cheapness of the exhaust fan for the purpose of ventilation. Tall chimneys are useless for the purpose of ventilation without heat when the difference between the internal temperature of the house and the temperature of the external air is insufficient to produce a current, and when they are doing their average duty they are far more inefficient than is generally supposed.



THE WING VENTILATOR.

From the reports on ventilation in the Barnes Hospital Washington, D. C., for 1876, the chimneys there used showed an average current of less than 200 feet per minute when the fan was not in use. The current is usually much less than this. In the record of ventilation of the Boston City Hospital, December, 1877, and January, 1878, the average velocity of the air passing through ventilators was about 100 feet per minute. In the Brooklyn school buildings—generally supposed to be well ventilated—it is found upon examination that many of the ventilating shafts are absolutely without currents, while some of the buildings, provided with what have been considered efficient ventilators, show a current ranging from 30 to 170 feet per minute, with the rooms heated, and in many of the churches and public buildings in this and other cities it is found that the ventilating flues are, in the majority of cases, either entirely dead or with a downward draught, sometimes being found entirely sealed to stop a downward draught of cold air. This array of facts indicates that the question of ventilation has been hitherto unsatisfactorily dealt with. The ventilator represented in the accompanying engraving is constructed on scientific principles, and is well calculated to fulfill the requirements of an efficient ventilator.

The ventilator shaft used in connection with this device is enlarged as it extends upward, so that each successive story of a building may discharge into it without interfering with the proper ventilation of the lower stories. The cowl into which the ventilating shaft discharges is large and nicely pivoted, so that it turns easily with the wind. Its flaring mouth gives it peculiar advantages over the ordinary form of cowl, so that this of itself is a very efficient ventilator; but the chief merit of this device lies in the arrangement of the fan and its propelling wind wheel seen at the top of the cowl.

All the parts are made to work very freely and with but little friction. The fans are arranged so as to swing around the inner periphery of the casing, leaving an undisturbed central core, while the enlarged hood and vertical position of the fans offer no resistance whatever to the upward current of air in case the fan should not be in motion. In motion they force the air out through the lateral opening, thus producing a vacuum, aiding the natural draught or creating one where there was none.

With the Wing fan ventilator it is found after many tests that when the wind is not strong enough to run the fan, the peculiar form of the cowl, its enlarged size, and prompt action in shifting itself to windward, will give a regular current of from 100 to 200 feet per minute; while with a fair to brisk wind to run the fan the velocity will go up to 300 and 400 feet, while with a strong wind it often records over 500 feet, and has in several cases reached over 600 feet per minute. Six tests made November 20, 1879, at St. Denis Hotel, where there is a 24 inch shaft capped with a Wing ventilator, showed an average of 438 feet, being an actual exhaust of fully 100,000 cubic feet of foul air per hour. December 22, 1879, in public school branch of 15, Brooklyn, six tests showed a current of from 225 to 357 feet per minute, with 8 12-inch pipes leading into two large pipes of 24 inches each, showing an exhaust of over 146,000 cubic feet per hour, with only a light wind and no fires. Later same day the one in Brooklyn *Eagle* building showed a current from 230 to 270 feet per minute. November 20, 1879, the Irving House, where there are two of these ventilators, one over each tier of water closets, gave a current of 525 feet, there being a good breeze.

The inventor gives us an instance in which eggs put last summer in a cold storage house provided with his ventilators had kept until winter perfectly, while those in similar houses without the ventilators had failed to keep in good condition, showing clearly the need of fresh dry air, even in the preservation of eggs. For smoky chimneys or to prevent down draught this ventilator is particularly adapted.

Mr. Wing furnishes us with the names of a large number of persons using his ventilator, and has shown us some very flattering testimonials in regard to its efficiency.

For further information address Mr. L. J. Wing, or the Simonds Manufacturing Company, 50 Cliff street, New York city.

MISCELLANEOUS INVENTIONS.

An improvement in apparatus for drawing and preserving malt liquors, patented by Mr. John Neumann, of New York city, is designed for the purpose of drawing malt and other liquors from a barrel or other vessel, without the admission of air or gas thereto, so that the liquor remaining at any time in the barrel will be prevented from becoming stale.

An improvement in snap hooks has been patented by Mr. John B. Hampton, of Pomeroy, Ohio. This invention relates to an improvement in fastening buckles, loops, and hooks to harness, bridles, etc., and the object thereof is to enable the connection to be made without stitching or riveting.

An improvement in swivels for bridle rein loops, patented

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by Mr. John B. Hampton, of Pomeroy, Ohio, consists of a bar adapted to be fastened to the bridle by rivets, having a slot through it and on either side thereof underneath a transverse recess for the reception of the studs projecting from either side of the end of the loop, which are passed through the slot in the plate, and then turned so as to rest in the said recesses, and thus form a swivel joint.

Mr. James McMurray, of East Portland, Oregon, has patented an improvement in cooking utensils. The object of this invention is to provide kettles, saucepans, and other cooking vessels with straining and steaming attachments, which shall be so constructed that they may be readily applied to the said vessels, and attached and detached, as required, and which shall be simple in construction and inexpensive in manufacture.

An improved machine for washing and beating silk and other threads and yarns when in the skein, has been patented by Mr. George Morlot, of Paterson, N. J. It is simple in construction and convenient and effective, removing all loose fibers and foreign particles, and forcing the water into and through all parts of the thread.

An improved tire shrinker has been patented by Messrs. George H. Stroud and John A. Shuman, of Sugar Run, Pa. The object of this invention is to provide a tire shrinker that will work effectually, and yet require no great exertion of power. It consists in combining with a movable plate and jaws a forked connecting rod, pivoted to the jaws, and a lever operated disk.

An improved brake for baby carriages, patented by Mr. William F. Wallberg, of Brooklyn, N. Y., is so constructed as to lock the wheels automatically whenever the handles are released, so that it will be impossible for the carriages to start forward accidentally.

An improved signal lantern, patented by Mr. Thomas S. Easterbrook, of Toledo, O., consists of a lantern globe having two opposite quarter sections colored, and the two intermediate ones uncolored, which globe is set in a lantern frame that has attached to it two quarter section metallic plates that are set opposite each other, so that by turning the globe the colored sections or lights of the globe may be covered by the plates and the uncolored or white lights only be shown, or the colored light be shown and the white be covered.

An improvement in window blind fasteners has been patented by Mr. William H. B. Allen, of Cambridge, Mass. This invention consists in a blind or shutter fastener operating to retain the blind open or closed and fitted for convenient manipulation. The inventor makes use of a pivoted catch and lever hung on the stile of the blind, which locks with the hinge staple to hold the blind in either position.

An improvement in dumping carts has been patented by Mr. George B. Wiestling, of Mont Alto, Pa. The object of this invention is to furnish carts, wagons, cars, and other vehicles so constructed that their bodies may be raised vertically, and also set in inclined positions, to facilitate the dumping of their contents.

The Eclipse of the Sun.

The line of totality of the eclipse of Sunday, January 10, crossed Central California and Southern Nevada, and penetrated nearly to the Great Salt Lake in Utah. Only in California, however, could favorable observations be taken, because the eclipse occurred so near sunset. Prof. Frisby, of the United States Navy, was sent, with a corps of observers, armed with powerful instruments, to the Pacific coast, and Prof. Davidson, with another corps of observers and a 6½ inch equatorial telescope, more powerful than the one Piazzi Smyth lugged up the Peak of Teneriffe, went into the Salenas Valley, which furrows the coast range, about 200 miles south of San Francisco, and within from 15 to 25 miles of the Pacific. Besides these, many private observers made elaborate preparations for observing the eclipse from various points within the line of totality. Apparatus for photographing the eclipsed sun was plentifully provided.

The first report came from Fresno, about 150 miles southeast of San Francisco, and within ten miles of the line of totality. The weather was perfectly clear. The first contact was visible at 2:45 P.M., and at 3:53 the observation became total.

As the last ray of sunlight disappeared, a corona of clear white light, entirely encircling the moon, flashed into view, brilliant at the edge of the moon and paling toward the outer limit of the halo. Next along the border, on the lower left third of the moon, appeared an irregular fringe of brilliant, sparkling primitive red and purple light, while at the top of the moon there was a bright yellow triangle of light equal in height to one-sixth of the diameter of the disk; a similar but smaller triangle appeared at the center of the right side of the moon, and from the upper and lower right side broad faint rays were projected. This appearance lasted thirty-one seconds, the corona remaining one minute longer. The sun disappeared behind the coast range before the eclipse had entirely passed.

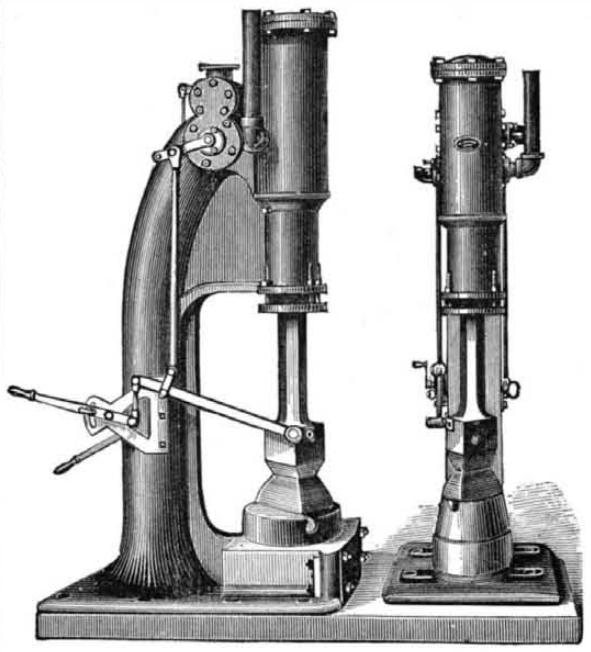
The only other dispatch from parties of observation, up to Jan. 14, came from Prof. George Davidson, of the Coast and Geodetic Survey, stationed at Mount Santa Lucia (5,700 feet above the sea), just south of Monterey, Cal., and but a short distance from the Pacific Ocean. Prof. Davidson says:

"After five days of fierce winds, rain, sleet, and snow, with a temperature of eleven degrees, the weather cleared on Sunday, and we had good observations both at the beginning and the ending of the totality. The totality lasted thirty-two seconds. The shadow was seen coming over the Pacific Ocean. There was a brilliant corona and red flame. Latitude and transit observations were obtained.

The United States Naval Observatory party, under Prof. Frisby, at the same station, are said, in a dispatch from Soledad, to have made successful observations. The first contact was within one and a half seconds of computed time.

IMPROVED STEAM HAMMER.

The annexed engraving represents two sizes of an improved steam hammer invented by Mr. David Bell, of Buffalo, N. Y. These hammers are very simple in construction and substantially built. The single column standard, the cylinder, and the bed piece are cast in one piece. The die block is cast separately and fitted in the bed plate.



BELL'S IMPROVED STEAM HAMMER.

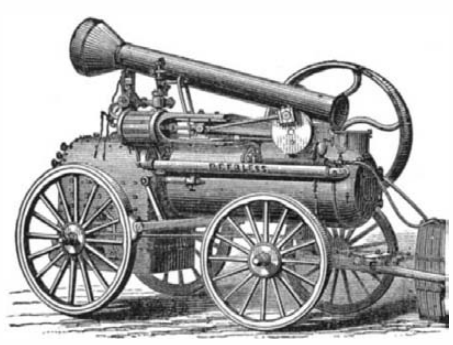
One of the hammers shown in the engraving has an eight inch cylinder and eighteen inch stroke, and the other has a ten inch cylinder and twenty-two inch stroke.

All the parts are very strong, and it is self and hand acting, and takes steam at both ends of the cylinder. The ten inch cylinder at ordinary steam pressure will strike a blow of from four to five thousand pounds. The stroke is perfectly automatic and can be made light or heavy as desired.

The hammer was shown by Mr. Bell at the Exhibition of the Mechanics' Institute held in Buffalo some years ago. The judges reported that it was the best hammer for forging and general blacksmith work on exhibition. Since that time he has made several improvements upon it, so as to perfect the invention, and it is now being used in six of the largest machine shops in Buffalo and also in other parts of the country, and all who have had experience with it pronounce it the best hammer in use.

THE PEERLESS PORTABLE STEAM ENGINE.

The annexed engraving represents a portable engine for agricultural and other purposes, which, in general design, completeness in construction and operation, ranks among the best of its class. It is built with a view to strength, compactness, durability, and efficiency.



THE PEERLESS PORTABLE STEAM ENGINE.

The boiler, which is of the locomotive type, has a fire box of unusual length, and so arranged that the fire is completely surrounded by water. The tubes, which are lapwelded, vary in number in different sizes of the engine, from twenty to fifty-five; in size from two inches to two and a quarter inches; in length from twenty-eight inches to fifty-two inches.

The smoke box, fire door, ash pan, steam blower, smoke stack, and other adjuncts, are neatly and conveniently arranged, and the boiler is provided with the necessary appurtenances, such as steam and water gauges, blow-off cocks, etc. The engine cylinder and the steam chest are combined in one casting, which is bolted at one end to a flange on the end of the frame or bed plate. This arrangement permits of the free expansion of the cylinder, as it rests upon a bracket attached to the boiler, and the boiler is free to expand and contract without straining either the engine or itself.

The saddle or bearings for the crank shaft are of the kind used in first class stationary engines, and are arranged to adjust from four sides, upper, lower, right, and left, with improved simple arrangement by which the bearings can be adjusted by persons who are inexperienced in the use of machinery, cannot be made too tight, and therefore can never be ruined from this cause. The bearings are made very large, and will run a long time before any adjustment is necessary. The support between the boiler and these bearings is cast hollow, through which all the water while cold, used to feed the boiler, must pass on its way to the pump, absorbing the heat which would otherwise cause the bearings and journals to become very hot. This valuable improvement, covering the new feature of a water passage between the boiler and the crank shaft bearings, for the purpose of keeping the journals and bearings cold, is secured by letters patent. When the water is not required in the boiler, the flow is kept up by opening a valve and allowing the water to return to the tank from which it was taken, thus keeping the bearings always cold, and never allowing the pump to become dry, but always working and ready to supply the boiler with water when required.

The engine and boiler can be mounted on a strong substantial truck or wagon, as represented, or on sills. All the parts are interchangeable, and none but the best materials are used, and the workmanship is of the best.

Further information may be obtained from the Geiser Manufacturing Company, Waynesboro, Franklin county, Pa.

MECHANICAL INVENTIONS.

An improvement in speed-accelerators has been patented by Mr. James Schofield, of New York city. The object of this invention is to convert slow or slight motion into rapid or extended motion by the intervention of ropes or chains and sheaves, for the purpose of propelling boats, vehicles, machinery, and the like. The invention consists, essentially, of a sliding carriage containing several sheaves, and fixed on a reciprocating rod, while over said sheaves and sets of corresponding standing sheaves fixed opposite, and at a distance, a rope or chain is passed back and forth in such a manner that a slight movement of the carriage will produce a very extended or accelerated movement of the bight of the rope or chain, or of objects attached to it.

An improvement in vehicle-wheel hubs has been patented by Mr. Lucius S. Edleblute, of Cincinnati, Ohio. This invention is an improvement in the class of metal wheel-hubs in which the spoke tenons or butts are clamped between flanged collars, one of which is adjustable on the axle-box to adapt it for convenient adjustment or removal, and it pertains to a peculiar construction and arrangement of parts which cannot be clearly described without an engraving.

Mr. Benjamin Slusser, of Sidney, Ohio, has invented an improved elevator for warehouses and other buildings, constructed with a view to securing greater safety against the sudden fall of the elevator platform from the breakage of the rope, and to provide against persons falling through the hatchways in the several floors. The invention consists in a novel automatic clutch for arresting the descent of the platform in the event of the sudden breakage of the rope, and in the peculiar means for opening and closing a set of automatically operated trap doors for the hatchways, which are opened above and closed after the platform in rising, and also opened below and closed above the platform in descending, so that at no time is the hatchway left open.

Mr. Lovren E. Hogue, of Sandy Lake, Pa., has invented an improved injector in which the lifting and forcing tubes are so constructed and arranged with regard to each other that the pressure may range from forty to one hundred and fifty pounds without requiring any change in their adjustment, the said construction and arrangement enabling the quantity of water to be so graded that three or more different quantities of water may be injected into the boiler.

The New Industrial Art School.

The new free school for workers in metal and wood was opened January 13, at No. 31 Union Square, under the management of the trustees of the Metropolitan Museum of Art. The object of the school will be to teach carvers in wood, engravers on gold, silver, steel, and other metals, and others how to design artistically, so as to do away with the old-fashioned method of designing from copy, and in this way to enable the workers to obtain higher prices for their work. The project had been long before the trustees of the Metropolitan Museum of Art, and the establishment of the school is due in great measure to the efforts of Messrs. Robert Hoe, Jr., William L. Andrews, W. E. Dodge, Jr., and Edward C. Moore and Professor Thomas Egleston. The school will be open from 7:30 to 9:30 P.M. The first class will be for workers in wood, and the above named gentlemen have invited workmen from the art establishments of the city who possess a knowledge of drawing and who wish further instruction to attend. A class for workers in metals has also been organized. The students will be allowed to copy from models brought from the collections of the museum. Many manufacturers have promised to do all they can toward making the school a success.

The industrial importance of schools of this nature can scarcely be over-estimated. Wherever they have been undertaken they have shown themselves the most efficient aids in raising the character of industrial art and the social and financial condition of the artisan. It is to be hoped that the young artisans of New York will be prompt to avail themselves of the privileges now offered them.

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The Shells of Pompeii.

Dr. Nicola Tiberi, an excellent naturalist, living at Resina, close to the site of Pompeii, has recently published a remarkable and well written memoir on the shells found in the ruined city. The point of view to which he directs attention is very different from that taken by the geologist, antiquary, artist, or architect. He treats of the shells found in the ruins, and which had served for food, or had been used by the Pompeians for ornament and other purposes. We know from Athenæus and other ancient authors that mollusca were then relished quite as much as they are at the present day by the inhabitants of Italy. Dr. Tiberi gives a list of all the shells which he has noticed as Pompeian, belonging to no less than 44 species, with particulars of their relative abundance at Pompeii, as well as of their distribution and economy. Some were of edible kinds, as the common oyster and mussel, *Pecten jacobæus*, *Venus chione*, *Tapes decussatus*, and several species of *Helix*. Others served to adorn fountains, as *Haliotis tuberculata*, *Murex trunculus*, and *M. brandaris*. The Oriental pearl shell (*Meleagrina margaritifera*) was represented by a single valve only.

But the ladies of Pompeii seemed to have attached considerable value to the *Cypræa*, or cowry, as amulets or charms to prevent sterility; and among these shells were some of the species from the Red Sea and the Persian Gulf. A single specimen of another exotic shell (*Conus textilis*) must have been kept for its great beauty as an object of curiosity. All the shells used in the ornamentation of fountains, five in the city and one in the suburbs, are of species which are still common in the Gulf of Naples; and these shells are separately distinguished and named. The memoir, which is a quarto pamphlet of twelve pages (*Le Conchiglia Pompeiane*, Napoli, 1879), forms a short but interesting chapter of Roman history, and tells us more than is generally known about the habits of the former masters of the world.

To Convert Common Agate into Onyx.

Following the attempt to produce minerals and precious stones artificially, comes the attempt to convert one mineral into another, a less costly into a more valued gem. Two Germans have patented a process for converting ordinary agate into onyx. Lorenz and Cullmann place the cut and polished agates for a week in a solution of iron in nitric acid only one millimeter deep, and then treat those portions of the stone which are to be white with a solution of equal parts of carbonate and hydrate of potash, dried, and burned in an earthen pot until the desired color is obtained.

Cannot some of our readers devise a method for converting ordinary feldspar, orthoclase, into Amazon stone? The latter has a bright emerald-green color, which is destroyed by heat, but brightened and intensified by certain hydrocarbons, like turpentine oil.

Different Solvents for Pyroxylene.

In the preparation of collodion the gun-cotton, or pyroxylene, is dissolved in a mixture of alcohol and ether; in the manufacture of celluloid the solvent is camphor. Bardy, the celebrated French chemist, has recently studied the action of other solvents, especially aceton, methylic alcohol, and glacial acetic acid. His results, as reported to the Photographic Society of France, were as follows:

Aceton, a liquid which resembles ether in its volatility, but unlike the latter miscible in all proportions with water, is one of the best known solvents of pyroxylene. It does not dissolve the firm cotton prepared at low temperatures as well as that in dust form made by Martin's process. On pouring the aceton solution into water, the solvent at once unites with the water and the cotton is precipitated in the form of large white flakes, which do not adhere together, and hence can be easily washed. When dry this cotton has a peculiar appearance; three grains of it occupy a space of nearly 200 c.c. It is not actually necessary to employ the pure aceton; if it gives no milky precipitate when poured into water and does not reduce salts of silver it is good enough.

Methylic alcohol, since its introduction into the manufacture of methyl violet, comes into commerce in a state of sufficient purity. It mixes with water in every proportion, and has no action upon silver salts. It dissolves pyroxylene easily, but the solution is more shiny than that in aceton. If poured at once into water it is precipitated as a compact gelatinous mass, difficult to wash out. The solution must be poured into cold water in a very fine stream, then a very voluminous mass is obtained; 25 grains occupy 2 liters of space, and can be readily washed out. On drying, the mass becomes horny, half transparent, and of an amber color. It dissolves readily in the mixture of alcohol and ether.

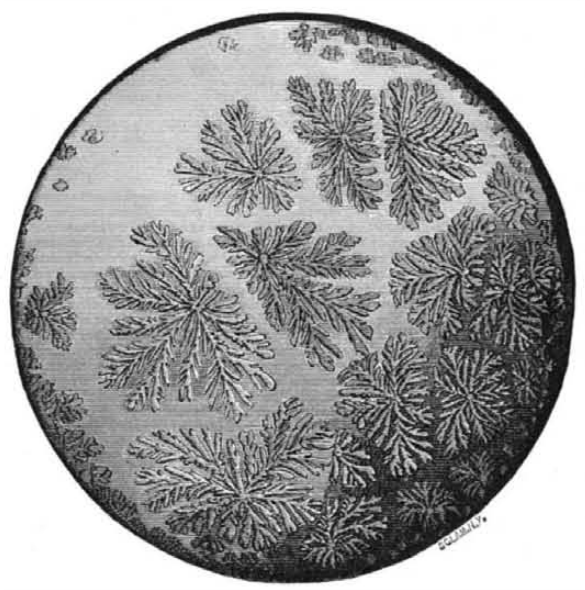
Crystallizable or glacial acetic acid dissolves pyroxylene, and when poured into water the solution acts like the aceton solution. On drying, every trace of the acetic acid is volatilized, leaving the cotton perfectly neutral. I. Z.

MANY persons know it, but some do not, that a pretty and easily grown window plant may be obtained by soaking a round piece of coarse sponge in warm water until it is thoroughly expanded. After squeezing it about half dry, place in the openings millet, red clover, and barley grass seeds, rice, and oats. Hang the sponge in a window where the sun shines a part of the day, and sprinkle it lightly with water every morning for a week. Soon tender leaves will shoot out, and, growing rapidly, will form a drooping mass of living green. If regularly sprinkled, it will later be dotted with the blossoms of the clover.

On a Curious Case of Crystallization in Canada Balsam.*

BY GEORGE F. BARKER.

Some time in the early spring of 1875, a party of hunters left Rawlins, Wyoming Territory, and went up into the Sweetwater country, a hundred miles north of that town, in search of game. While absent one of the party lost a valuable field glass. In the summer of 1878 a party of Ute Indians came into Rawlins, having in their possession the lost field glass. It had lain out exposed to the weather for over three years, and of course showed the hard usage it had undergone. The eye lenses, however, were in excellent condition, but the achromatic object glasses were covered with an abundant arborescent crystallization, which rendered them quite opaque. My friend, Mr. Galbraith, of Rawlins, who had become their owner, first called my attention to them, and, supposing the crystallization to be in the glass itself, he sent one of the lenses to me as a pattern, in order to have a pair of new ones made in place of the spoiled ones. On examining the lens, however, in connection with Mr. Zeutmayer, it was evident that the crystallization was not in the glass, but in the Canada balsam used for cementing the components of the achromatic. At my request, therefore, the second lens was sent to me, so that by cleaning off the old balsam and recementing, both would become perfect again. The crystalline forms of this second lens were so beautiful that I desired to preserve them. So I applied to Mr. E. L. Wilson to photograph them for me. He took a warm interest in the matter and produced four negatives, one of the first and less beautifully crystallized lens, and three of the other one, each with a different illumination. I present to the Section prints from these exquisite photographs. (The accompanying wood cut has been engraved from one of the best of these photographs.) It will at once be seen on inspection that these arborescent forms are of great beauty, the fineness of the subdivisions being quite remarkable. The most curious thing about these forms, however, is the fact that they are themselves hollow and are surrounded by the crystallizing material, the balsam. Hence the supposition that we have here the crystallization of some constituent of the balsam is at once negatived. Canada balsam, as is well known, is a complex mixture of two or three resins dissolved in a volatile oil. Now, since one of these resins is crystallizable, it might be supposed that during the intense cold to which the glass was exposed, this resin had crystallized out in these forms. But in that case the crystals would be solid, not hollow. So also of the suggestion that this is a frost-like or dendritic crystallization of some infiltered material. The crystals in that case would also be solid, unless we suppose their subsequent removal leaving the cavity. But a close examination of the branchlets with a glass shows that they have been formed by a gradual withdrawal of the crystallizing material from several nuclei simultaneously, thus becoming the centers of the radiations. This is evident from the curved lines in the larger branches, concentric with their rounded ends. The most probable hypothesis is that the crystallization has been induced or directed by some constituent of the balsam itself. But the precise conditions under which it has taken place do not seem clear. The building up of a crystal by the aggregation of molecules according to their polarities, or the demounting of a crystal by solvents in regular forms, is simple in comparison. The branchings do not take place at right angles, it will be noticed, but at 30°, which suggests hexagonal crystallization.



Cameo Shells and Cameo Cutting.

The word *cameo* is derived from the Arabic, and is equivalent in signification to bass-relief. It was originally restricted to hard stones, such as onyx, sardonyx, etc., engraved in relief, but the term has since been extended to include gems cut on shell, lava, and other substances. Certain descriptions of univalve shells are well adapted for cameo cutting, from their substance being made up of different colored layers, and also from a difference of hardness and texture, and the various layers—some approaching more nearly to the nature of a nacreous than of a porcelanous material. The good workman always carefully puts his work on the shell in such a manner that the direction of the laminæ of the central coat is longitudinal. In cameos the central layer forms the body of the relief, the inner layer being the ground, and the outer the third or superficial color, which is sometimes used to give a varied appearance to the surface of the figure. The cameo cutter selects from the shells which possess the three layers: (1) those which have the layers strongly adherent to each other; (2) those in which the middle layer is thick; (3) those in which there is a good distinction of color between the layers; and (4) those in which the inner layer is of the color suited for his purpose.

The kinds of shells now employed, and which experience has shown to be best for the purpose, are: The "Bull's Mouth" (*Cassis rufa*), which has a *red* inner coat, or what is known as a *sardonyx* ground; the "Black Helmet" (*Cassis Madagascariensis*), which has a blackish inner coat, forming what is called an *onyx* ground, and which shows up white on a dark claret color; the "Horned Helmet" (*Cassis cornuta*), white on an *orange-yellow* ground; and the "Queen Conch" (*Strombus gigas*), with a *pink* ground. The latter shell is about ten inches long, with a rose-colored aperture and an extremely broad lip rounded above. The bull's mouth and the black helmet are the best shells, for the horned helmet is apt to separate from the ground, or to "double," as the French workmen express it. The queen conch seldom has the two colors distinctly marked from each other, and the pink of the ground fades on exposure to light. The red color of the bull's mouth extends but a short distance within the mouth of the shell, and becomes paler as it proceeds inwards. Hence this shell affords only a single cameo large enough for a brooch and several small pieces for shirt studs, while the black helmet furnishes on an average about five brooches and several stud pieces. The queen conch yields only a single good piece. *Cassis flammea*, which is about six inches long, and *C. decussata* and *C. tuberosa*, which are white upon a dark claret color, are also occasionally used. The bull's mouth shells are derived from India and Ceylon, and the black helmets and queen conchs from the West Indies.

Genoa and Rome are the seats of the best work in cameo cutting, although many common ones are cut in France. In Rome there are about 80 shell cameo cutters, and in Genoa 30. The art of cameo cutting was confined to Rome for upwards of 40 years, and to Italy until the last 26 years, when an Italian began the practice of the art in Paris, and now over 3,000 persons are employed in the industry in the latter city. In the practice of cameo cutting the shell is first cut into pieces the size of the required cameo by means of diamond dust and the slitting mill, or by a blade of steel fed with emery and water. It is then shaped into a square, oval, or other form on the grindstone, and the edge finished with oil stone. It is next cemented to a block of wood, which serves as a handle to be grasped by the artist while tracing out with a pencil the figure to be cut on the shell. The pencil mark is followed by a sharp point, which scratches the desired outline, and this again by delicate tools of steel wire, flattened at the end and hardened, and by files and gravers for the removal of the superfluous portion of the white enamel.

The careful manipulation necessary in this work can only be acquired by long experience; the general shape must first be wrought, care being taken to leave every projection rather in excess, to be gradually reduced as the details and finish of the work are approached. Throughout the cutting great caution must be observed that in removing the white thickness the colored ground is not damaged, for the natural surface of the dark layer is far superior to any that can be given artificially.

In order that the finished cameo may possess a distinct outline at all points of view, it is desirable to adopt the system followed in antique cameos, viz., to leave all the edges of the figure quite square from the ground, and not gradually rounded down to the dark surface; for should the latter practice be followed the outline would be found to be undefined in many places, owing to the color of the white figure in relief gradually merging into that of the dark ground. The surface of the cameo is finished as nearly as possible with the cutting tools, as all polishing with abrasive powders is liable to remove the sharp edges of the figures and deteriorate the cameo by leaving the form undefined. When, however, the work has been finished as smoothly as possible with cutting tools, the final polish may be given by a little putty powder used dry, upon a moderately stiff brush, and applied with great care, and rather to the dark ground than to the carved surface. This is the concluding process, after which the cameo is ready for removing from the block prior to mounting.

The various styles in which these works of art are mounted depends a great deal upon the country where they are to be worn. There are tricks in this business as well as in most others; a fraud is frequently practiced by cutting away the engraved part of old shell cameos, and attaching this to a base of agate, by means of which an appearance of onyx is obtained.

As an illustration of the prolific capabilities of our inventors we may say that over 240 patents appertaining to the art of soldering have been granted. In Canada only two patents of the kind have been issued.

* Read at the Saratoga meeting of the American Association for the Advancement of Science.

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AGRICULTURAL INVENTIONS.

Mr. John P. Smith, of Claverack, N. Y., has patented an improvement in thrashing machines for which letters patent No. 53,694 were issued to him April 3, 1866. The improvement consists in so combining a perforated apron and concaves with the rotary cylinder of a thrasher as to create an upward blast through the apron to lift and assist in carrying the straw to the cylinder.

An improvement in cotton scrapers, choppers, and dirters has been patented by Messrs. Samuel A. De Force and William V. McConnell, of Crockett, Texas. The object of this invention is to furnish an improved machine for cultivating cotton which shall be so constructed as to bar off, scrape, chop, and dirt the cotton upon both sides of a row at one passage.

Mr. William R. Iles, of Fairmount, Ill., has invented an improved check-row planter, of that general form in which a cord or chain is provided at regular intervals with lugs, tappets, or knots, which cord is staked upon opposite sides of the field, and which knots or tappets, as the machine is drawn across the field, successively operate the dropping devices to cause the corn to be dropped in perfect check row. The improvements consist in the novel construction of the device upon which the cord or chain acts to impart the motion to the seed slides, and in the peculiar construction of guides from which the rope or chain passes out to the front and rear of the machine.

NEW SYSTEM OF DIGGING AND CURBING WELLS.

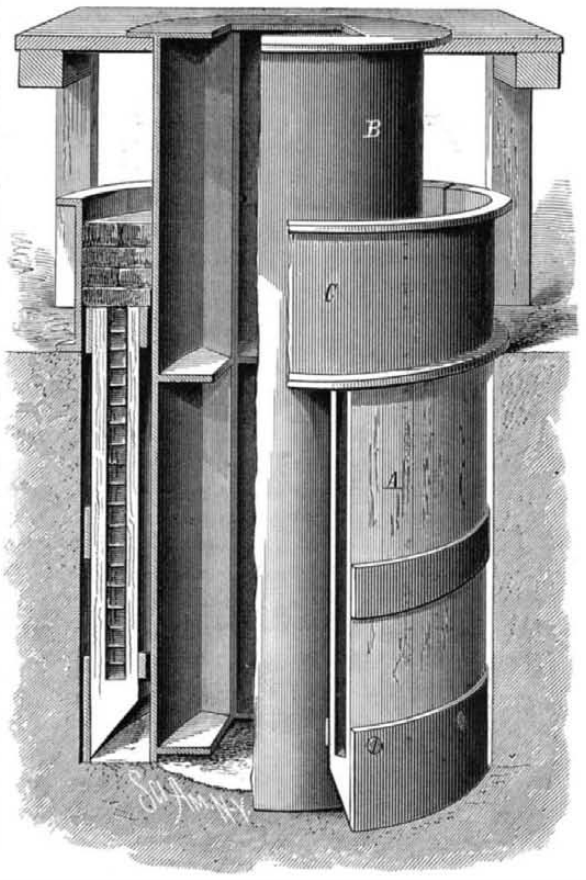
The annexed engraving represents a novel method and apparatus for digging and curbing wells, recently patented by Mr. Christopher C. Hackett, of Floyd, West Carroll Parish, La. The invention is intended to secure accuracy in the shape of the well and in the direction of digging; it permits of proceeding simultaneously with the two operations of digging and curbing, and it prevents the caving in of the well. In the engraving, which is partly broken away to show the internal construction, the sand box, A, which is shown as just entering the shaft, forms the foundation of the wall, and follows the shaft as it is dug by the workman. This box is made of wood, and is hollow from the top nearly to the bottom. Below the hollow portion the staves are chamfered off from the inside to give a narrow bearing edge. The staves are held together by iron hoops upon the outside, and wooden hoops on the inside, and the annular chamber formed between the staves is filled with masonry. A platform is erected over the well shaft at the proper height to enable the workman to lay the well curb or wall underneath.

An inside guide, B, consists of segments forming a cylinder, of a diameter just sufficient to allow it to fit inside the sand box. The wall is supported by an outside guide, C, a little larger than the sand box, which rests on the earth at the edges of the mouth of the shaft. For the sake of convenience in placing and removing, it is divided diametrically.

The invention is applied by sinking the sand box, A, into the shaft its full depth, then the platform is erected over it, and the sectional inside guide, B, is passed down in the sand box. The workman then proceeds with the digging, and as he deepens the shaft the sand box sinks, and the wall or curb is built on top of the sand box between the walls of the inside guide, B, and those of the outside guide, C.

The thickness of the curbing or wall equals the thickness of the walls of the sand box, and the inside and outside guides supply a sure guide for building it. As the shaft deepens, the sand box, and with it the finished curb built upon it, sinks.

In this way the digging and curbing are carried on at the same time. The chamfered lower part of the sand box permits the workman to reach with his tools to the edge of the box, so that he can dig evenly all around and underneath it, and thus let it descend evenly. Above the platform an ordinary derrick is erected, with a windlass, pulleys, etc., for lowering the sections of the inside guide, and hauling up the detritus. If, after the well is dug, the water should fall below the top of the sand box, and thereby expose it to decay, the brick filling or masonry contained in it will remain as the foundation of the well or curbing, and thus prevent it from caving in.



HACKETT'S IMPROVEMENT IN DIGGING AND CURBING WELLS.

The inventor informs us that wells made on this plan are free from surface water, and are shut out from contamination by the infiltration of sewage, as the walls may be made perfectly tight by the use of cement, and no water can enter that does not come from the fountain head. This is a very essential feature where wells are still in use in the larger towns and cities, and it is not less so in the country, where now, in a large proportion of cases, foul water from the cattle yards finds its way into the wells.

LIGHT LOCOMOTIVES.

Persons who are familiar only with the ponderous locomotives that are used on the great through freight and passenger lines would hardly recognize their kinship to the many varieties of light locomotives that are used for all kinds of special service. We present illustrations and descriptions of a few of these light locomotives, built by H. K. Porter & Co., of Pittsburg, Pa., whose shop, we are informed, is the only one in this country exclusively occupied by this kind of work.

MINE LOCOMOTIVES.

The adaptation of the light locomotive to use inside of mines involves modifications which change its outward appearance without specially affecting the working machinery. The smoke stack is shortened, the roomy wooden cab is replaced by a low iron canopy, the steam dome is reduced in height, and a special throttle valve used to secure dry steam; and the sand boxes and whistle are placed out of the way. Some of these mine locomotives never see the light of day; they are sometimes little more than four feet in height, so that a man can easily look down the smoke pipe while standing alongside of the track, and if he has tolerably long legs he can ride the locomotive sitting astride the water tank. In spite of their diminutive size these little turtle-shaped machines are very powerful. One engine does the work of ten to thirty or more mules, at about the daily expense of operating two to four mules, while the cost of the engine is usually rather less than that of the animals it replaces. Its life is longer, and it consumes nothing while standing still during any suspension of mining, for it only needs a few cents' worth of white lead and tallow to keep it in good condition while standing in its stall; mules, on the other hand, do not have diminished appetites when not at work. Another important advantage of the locomotive over animal power is its ability to haul extra heavy loads and make more frequent trips whenever an increased output is desired, and this is done without any additional investment beyond a trifle more coal and water used. To increase the output by animal power involves an increase in their number, for flesh and blood have not the capacity possessed by iron and steam to endure overwork.

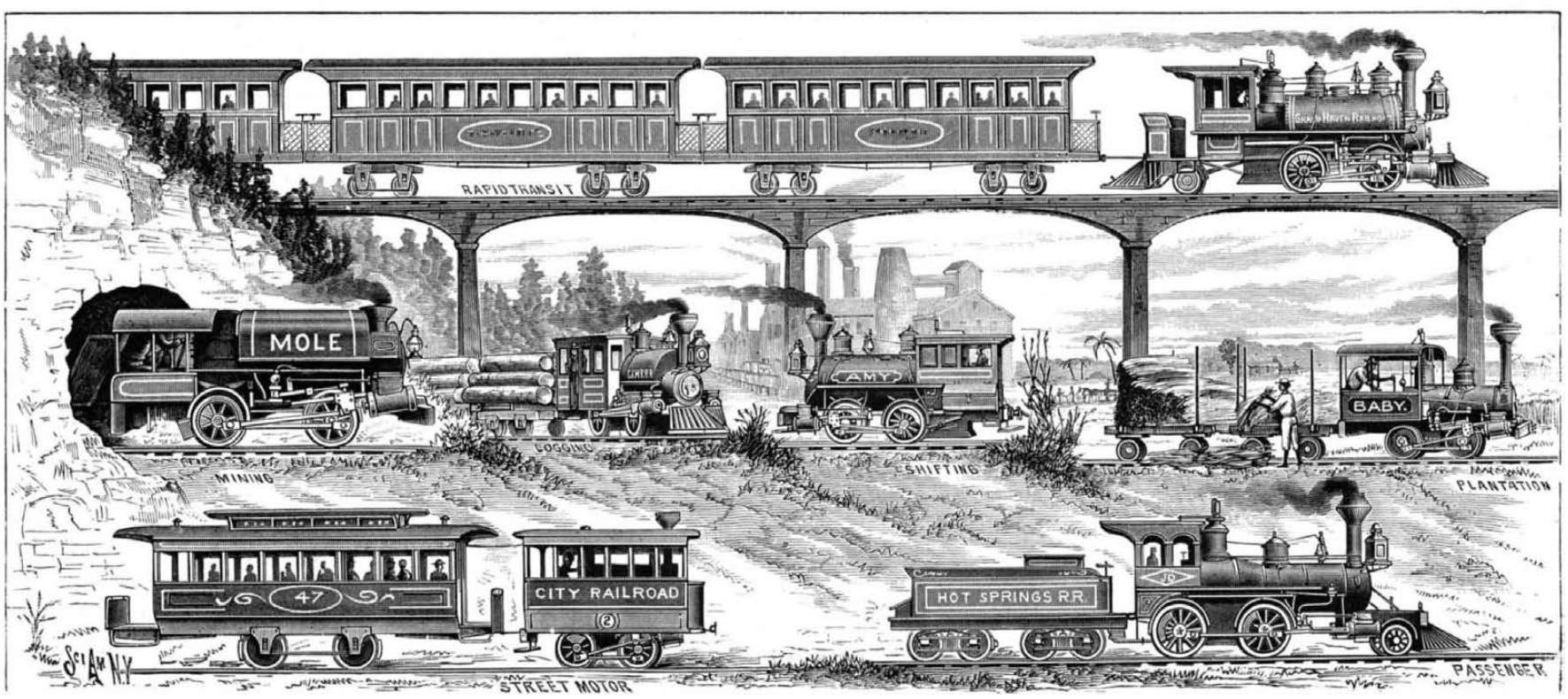
Mine locomotives are not only valuable in coal mining, but are also well suited to the mining of precious metals, where they effect such a saving as to bring into the market great quantities of low grade ores which are not rich enough to pay for hauling by animals.

The economy of locomotive over animal power applies of course to all kinds of surface tramways as well as to underground hauling.

LOGGING LOCOMOTIVES.

The quantity of lumber used annually in the United States is enormous, and one large item in the cost is the expense of hauling the logs to where they may be floated or carried by rail to the mills. This is now done to a great extent by light locomotives on cheaply built railroads. In the northern districts logs are also hauled on sleds over the snow. This is impracticable for long distances and is expensive in all cases, and is liable to interruption in mild or open winters, in which case the logs left in the woods till the next season are often destroyed by boring worms, fire, and decay. The locomotive is independent of the season of the year, and is capable of hauling immense quantities of logs and to run twenty-four hours a day when the price of lumber makes this desirable. The hauling is done so cheaply that "culled" or poorer grades of logs, which would otherwise be left to rot in the woods, can be profitably marketed, and a logging operator can make a handsome profit when selling at what are cost prices to others who haul by animal power. The size and style of the locomotive, and the weight of the rail used depend on the amount of business and the length of the haul. The whole outlay for a steam logging railroad is about fifty cents to one dollar for each thousand feet of lumber readily reached by it, or considerably less for large tracts. When the tract is all cut off, the railroad may be shifted to another tract at slight expense.

One of the most important logging railroads in Michigan is some thirteen miles long and uses four locomotives, each of eight tons weight. Several square miles are annually cut off to furnish it with freight, which runs up to about a half million tons each year. Like many of these roads it has no railroad connection, and the only communication



LIGHT LOCOMOTIVES BUILT BY H. K. PORTER & CO., PITTSBURG, PA.

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with civilization is by a wagon road some fifteen miles long. Over this road, which for most of the distance is hardly more than a cart track of the roughest description, the rails and rolling stock were hauled. The locomotives were taken in pieces, with the exception of one, which was so urgently needed that, to save time it was fired up and run by its own steam, without any rails at all, over the dirt road to its destination. A force of men, equipped with levers to steer the engine round corners, went ahead, and wagons carrying water and fuel followed. The journey was made without accident and much to the amazement of the lumber choppers, who were not accustomed to see locomotives traveling through pine forests in search of a railroad.

Lake Tahoe, California, is a beautiful body of water surrounded by mountains. It is noted for its clearness and depth, and it is said that the bodies of those drowned in it never rise. It is now utilized for logging purposes, being reached by a chute one third of a mile long, down which the logs, weighing from five to ten tons each, slide in less than half a minute, followed by a track of smoke and flame. The report made when a log strikes the water is heard a mile away, and the spray is thrown into the air as high as a church steeple. These immense logs are all carried along the mountain sides to the top of the chute by a little logging locomotive whose weight is less than many of the logs it hauls.

At Dutch Flat, Cal., a novel and ingenious application of locomotive power is in use. The track of the logging railroad runs high up along the mountains, and a great part of the timber grows on the sides and bottoms of precipitous cañons. An inclined plane, 1,200 feet long, with a perpendicular descent of 600 feet, runs from the railroad down the mountain, and the locomotive is run on to a siding where friction rollers are set in the track. Resting on these rollers the locomotive driving wheels turn twenty miles an hour without advancing an inch, but the motion is communicated from the rollers by gear wheels to a drum on which is wound a steel wire rope. By this simple device a twelve-ton locomotive pulls up a load much heavier than itself. When enough logs have been hoisted to make a train load, the locomotive is run on to the main track again, and pursues the even tenor of its way just as if it had not been transformed into a stationary engine. The same attachment may be used to supply power to a sawmill or other machinery.

PLANTATION LOCOMOTIVES.

In tropical countries, where the soil is very soft and the sun's heat excessive, light locomotives have been introduced lately for carrying sugar cane from the fields to the crushing mills, hauling fuel and supplies, and doing other work as desired. For such roads the rails and cross ties are usually furnished by the manufacturer all put together ready to lay, so that the track is more or less of a portable character. Rails of about sixteen pounds weight per yard are used, and the track is not often kept in good order, especially in the rainy season, when it may be so covered with mud as to be invisible. Farm hands, coolies, Chinese, or negroes are likely to be pressed into service as engineers, and under such circumstances the simpler and stronger the machinery the better, while on the other hand the locomotive must be as light as possible. The manufacturers inform us that the plantation locomotive shown in the illustration meets the conflicting requirements of this service admirably. The cylinders of the smallest size are only five inches in diameter and ten inches in stroke, the driving wheels twenty-two inches diameter, and the entire weight, in running order, only about three tons. The water tanks are placed under the engineer's seats, and either coal or wood, or "bagasse" (the dry-pressed cane), may be used for fuel. Larger sizes, requiring heavier rails, are also built. Sometimes a pair of pony wheels support a water tank placed at the rear end, nd sometimes the tank is placed over the cylindrical parts of the boiler. These locomotives are used on the sugar plantations of the Southern States as well as in the West Indies. The gauge of track varies from two to three feet.

SHIFTING LOCOMOTIVES.

Nowadays almost every large establishment situated on a railroad, and having side tracks for receiving and shipping by car loads, owns its own shifting locomotive. Some of the larger iron and steel works operate as many as a dozen locomotives of this class. Compared with shifting cars by a gang of men with pinch bars or by teams of horses, or with depending on the railroad company for placing cars where they are wanted, the economy and convenience of owning a shifting engine is very marked. Where a narrow gauge track is also used for hauling coal, ore, lumber, or other supplies, a third rail is often laid on the wide gauge siding, and the narrow gauge engine does the shifting and work for both tracks. One remarkable feature of these shifting locomotives is their great power as compared with their small size. This is due to the fact that all their weight is placed on the driving wheels, and is used for traction. They have repeatedly hauled trains that larger engines of usual construction could not move. This, to an ordinary observer, seems impossible, but is readily understood by a mathematical comparison of the proportions between the size of the driving wheels, the useful weight, and the cylinder capacity.

SPECIAL SERVICE LOCOMOTIVES.

Light locomotives of the same general styles of those made for logging railroads, plantations, and for shifting are also put to a great variety of uses, as, for instance, hauling mud from dredging machines to fill up low and worthless lands; pushing white-hot ingots of Bessemer steel at rail mills; carrying the crude material of the well known superphosphates; for moving stone and earth at great engineering works, such as the Hoosac and Musconetcong Tunnels, the Rapids Improvements near Keokuk, and the government works at Mussel Shoals; for removing cinder at blast furnaces, and for miscellaneous hauling at coal and iron works, quarries, and other places.

We present, also, illustrations of light locomotives specially designed for rapid transit on surface or elevated roads, for street railroads, and for narrow gauge railroads.

For more detailed description of the performances of light locomotives, their weight, dimensions, and general construction, and other items of general interest connected with their use, the reader is referred to the illustrated catalogue of Messrs. H. K. Porter & Co., of Pittsburg, Pa.

THE HYENA DOG.

Just as the Aard wolf appears to form the link between the civets and the hyænas, being with some difficulty referred to either group of animals, so the hunting dog seems to be the connecting link between the dogs and the hyænas. Its position, however, in the scale of animated nature is so very obscure that it has been placed by some zoologists among the dogs and by others among the hyænas. As, however, the leading characteristic of its formation appears to tend rather toward the canine than the hyænine type, the hunting dog has been provisionally placed at the end of the dogs rather than at the end of the hyænas.

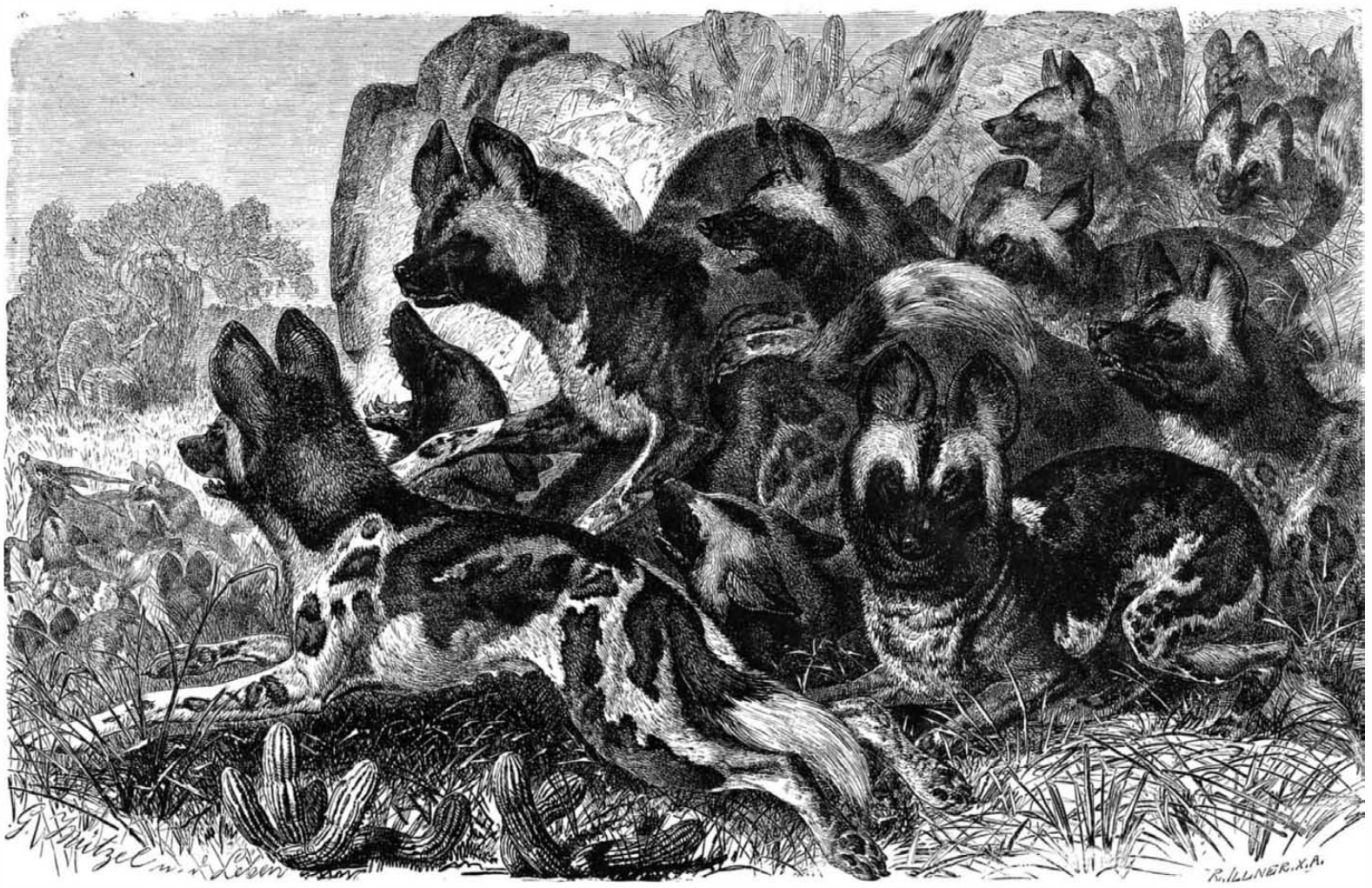
In its general aspect there is much of the hyænine character, and the creature has often been mistaken for a hyæna, and described under that name. There is, however, less of the hyænine type than is seen in the Aard wolf, for the peculiar ridge of hair that decorates the neck of the hyæna is absent in the hunting dog, and the hinder quarters are not marked by that strange sloping form which is so characteristic of the hyæna and the Aard wolf itself. The teeth are almost precisely like those of the dogs, with the exception of a slight difference in the false molars, and therefore are quite distinct from those of the hyænas. But the feet are only furnished with four toes instead of five, which is a characteristic of the hyænas, and not of the dogs. Several other remarkable points of structure are found in this curious animal, some of them tending to give it a position among the dogs, and others appearing to refer it to the hyænas.

The general color of the hunting dog is a reddish or yellowish brown, marked at wide intervals with large patches of black and white. The nose and muzzle are black, and the central line of the head is marked with a well-defined black stripe, which reaches to the back of the head. The ears are extremely large, and are covered on both their faces with rather short black hairs. From their inside edge rises a large tuft of long white hair, which spreads over and nearly fills the cavity of the ear. The tail is covered with long bushy hair, which is for the greater part of a grayish-white hue, but is strongly tinged with black near its insertion. In nearly all specimens there is a whitish patch below each eye. These tints are somewhat variable in different individuals, but preserve the same general aspect in all.

There are many names by which this animal has been called; in the writings of some authors it is mentioned under the title of the painted hyæna, while by others it is termed the hyæna dog. The Dutch colonists of the Cape of Good Hope, where this creature is generally found, speak of it by the name of wilde hund, or wild dog; and it is also known under the names of simir and melbia.

Its title of hunting dog is earned by its habit of pursuing game by fair chase, and uniting in packs of considerable numbers for that purpose. As is the case with the generality of predaceous animals, it prefers the night for its season of attack, but will frequently undertake a chase in broad daylight. For the purpose of the chase it is well fitted, as it is gifted with long and agile limbs and with great endurance of fatigue.

A successful and practical sportsman, who has witnessed the performances of fox hounds and hunting dogs, is inclined to give the palm to the latter animals, for their almost in



HYENA DOG.—*Lycaon venaticus.*

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variable success in the chase. He suggests that to the ample nostrils and the wide forehead of the hunting dog must be attributed much of the keen scent and the apt intelligence that renders these animals so successful in their united efforts. He also offers a further suggestion, that it appears as though freedom were a necessary adjunct to the hunting spirit, for we cannot train any animal to hunt with half the real zest which the same creature exhibits in its native or wild state.

When brought under human control, it is rather apt to retain its native ferocity, and to reject the companionship of mankind. Yet it has been known to enter into friendship with other animals, such as the hyæna and the lion, and was not more quarrelsome than is ordinarily the case among predaceous animals of different species. The experiment of its domestication has not as yet been fairly tried; and in all probability the creature will yield to the influence of man without any difficulty, whenever it may be subjected to the authority of a competent teacher.

The Long Island Scallop Fisheries.

In a detailed account of the scallop industry of New Suffolk, Long Island, prepared for the *Herald*, we find the following facts of general interest:

The favorite grounds for the fishing, or rather dredging, is in a line drawn from northwest to southeast across Peconic Bay from New Suffolk toward Southampton on the eastern shore. Here the scallops are always found. The dredging is done in waters from 3 or 4 feet in depth to 5 or 6 fathoms. The dredge is shaped like an old-fashioned dirt-road scoop. The lower rim or scraping iron is probably 2½ feet long, an inch wide, and a good ⅜ thick. To this is attached a piece of chain netting of 2 feet depth. Over this is the same length of cord netting, running from its attached end to the chains joined to a round bar of iron, which forms the upper part of this bag or pouch. A handle of iron, with an eye at the end, runs from where the upper and lower sides of the pouch are joined together. To the eye mentioned is attached the dragging rope. Thus equipped the vessels sail backward and forward over the beds, scooping in the shell fish as they lie huddled on the bottom. The scallop is a peculiar bivalve. Unlike the clam or the oyster, which seems incapable of progressive motion, the scallop is a rover.

When the tide is running fast and the water shallow it will rise from the bottom, with open shells, to the top of the water, squirt out the water contained between the shells, and by means of the impetus given and the force of the tide, will swim a yard or so at every spring. The motion is a laughable one, as the shells come together with a snap that can be heard some distance, and the motion is zigzag instead of direct. Some seasons the fish are much larger and finer than others. Thus this year they have been small. Last year they were twice the size. The catch is from twenty to a hundred bushels a day, according to the size of the boat and number of men engaged.

From November 1 till March is the fishing season. The catch varies; for the crop of scallops, like crops raised on land, changes with the season. Thus this year the catch has been a light one, and prices at the grounds have been as high as $1 for a gallon of meats, or, as the fishermen say, "eyes." The great crop, or bonanza year, was in 1877, when it was estimated that from the ports of Riverhead, Mattituck, New Suffolk, and Greenport the shipment to our city ran up to the large number of 40,000 gallons. The price, however, ran down as low as 50 cents per gallon, barely paying expenses.

Of the ports named New Suffolk is the chief, and has the largest number of individuals engaged in the trade. Fourteen vessels, in size from the cat rigged sailboat, of a couple of tons register, to the schooner rigged vessel of twenty, hail from New Suffolk, The crews run from a man and a boy on the smaller to a half dozen able-bodied men on the larger boats. The work is of the hardest and is of the coldest sort.

The number of those employed at New Suffolk—scallop headquarters—is about 150 of all ages, from men and women of sixty all the way down to boys and girls of ten and twelve. In the year 1877 the largest shipment ever made was forwarded; this was close to 40,000 gallons of eyes, or representing a catch of 80,000 bushels of scallops. Last year the catch was but half that, while this season it will not run so heavy as last. The old hands say that the scallop lives but three years; that the spawned fish is two years reaching maturity; the third year it is full grown and spawns, and then dies.

This multitude of scallops attracts to the waters of Peconic Bay thousands of water fowl. Black duck, geese, loons, and the common non-edible duck, such as coots, old squaws, and whistlers, are in immense numbers, while the gulls fairly whiten the sand bars when the receding tide leaves the sands bare.

The Croton Bug as a Library Pest.

At a meeting of the American Library Association, in Boston, Mr. Weston Flint made a brief statement of the injury done by the croton bug upon the covers of books. He stated that he had found these insects the worst pests that libraries have to suffer from in this latitude, and that he had noticed that they were often carried about in packages of books from the bindery. They attack the starch or sizing in the cloth covers, and often destroy the gold literally to secure the little albumen used in that work. After several trials, Mr. Flint found that the most effective remedy against these pests was a plentiful supply of a powder in which *Pyrethrum* was the principal ingredient. With a small bellows, this powder was thrown among the books on the shelves and allowed to remain. This operation performed once a year seems to be sufficient to keep them out. Mr. Flint having written to Prof. C. V. Riley in regard to the habits of the insect, that gentleman replies as follows: "The name of croton bug is *Blatta Germanica*, an insect originally introduced into this country from Europe, just as its larger conquerer, *B. Orientalis*, was. I have long considered it the worst pest we have in the libraries, and was not a little surprised that Dr. Hogen made no mention of it in his paper read before the American Library Association. The larger species (*Orientalis*) also helps in the work, as shown by what Dr. Hogen quotes from Mr. J. A. Lintner; but the croton bug is so much worse than any of the others, that all combined are not as mischievous. It shows a decided preference for books bound in green cloth, and seems to me to gnaw into and loosen the fibers of the fabric solely for the purpose of getting at the sizing or enameling. The worst of it is that this pest attacks books in the best kept libraries, and is indifferent whether the works be old and musty or just from the bindery; and the newly hatched roaches get through such a small crevice, that it is very difficult to get a bookcase tight enough to exclude them. I have been able to discover no remedy beyond diligence and the use of a little *Pyrethrum* occasionally sprinkled about on the shelves; but I make it a point nowadays to have all books bound in leather, such not being touched by the *Blattas*. This, and the other fact that it confines its injuries to the outside of the book and never affects the inside or more essential part thereof, form the only two redeeming traits in the little rascal's habits." Mr. Flint (who is librarian of the United States Patent Office) adds that one care should always be taken; and that is to open packages coming from the bindery before they are admitted to a library. This will keep them out, If they do get among the books, use the *Pyrethrum* powder immediately.

The Uses of the Potato.

In France the farina is largely used for culinary purposes. The famous gravies, sauces, and soups of France are largely indebted for their excellence to that source, and the bread and pastry equally so, while a great deal of the so-called cognac, imported into England from France, is distilled from the potato. Throughout Germany the same uses are common. In Poland the manufacture of spirits from the potato is a most extensive trade. "Stettin brandy," well known in commerce, is largely imported into England, and is sent from thence to many of our foreign possessions as the produce of the grape, and is placed on many a table of England as the same; while the fair ladies of our country perfume themselves with the spirit of potato under the designation of *eau de Cologne*. But there are other uses which this esculent is turned to abroad. After extracting the farina, the pulp is manufactured into ornamental articles, such as picture frames, snuff boxes, and several descriptions of toys, and the water that runs from it in the process of manufacture is a most valuable scourer.

For perfectly cleansing woolens, and such like articles, it is the housewife's panacea; and if the washerwoman happens to have chilblains she becomes cured by the operation.

Few persons are aware of the great demand for potato flour, and of the almost unlimited extent of the market that can be found for this product, which is simply the dry evaporated pulp of the ordinary potato—the whiter and more free from black specks the better. It is used for sizing and other manufacturing purposes, and by precipitation and with the aid of acid is turned into starch. In Europe it meets with a large and increasing demand in its primitive state, as potato flour, and in Lancashire alone 20,000 tons are sold annually, and as many more would be taken if put on the market. When calcined it is used largely for silk dressing and other purposes. At present the quotation for potato flour in Liverpool is nearly double that of wheat flour. Consignments to Liverpool are solicited by the brokers there, who promise to take all that can be furnished.

During the Franco-German war the French Government purchased all the farina it could secure and mixed it with wheaten flour in "potato cakes" for the army. Farina at that time rose to £40 a ton, and even the supply fell far short of the demand. Since then an increased amount of farina has been regularly consumed in France, and farina mills have correspondingly multiplied in that country. The manufacture of potato flour is so simple, and the results so methodical, that it requires very little experience to reach a satisfactory issue. The potatoes are first steeped in water from six to twelve hours to soften the dirt and other matter adhering, after which they are thoroughly washed by mechanical means with the aid of either steam or water power. They are then reduced to a pulp by a rasping or grinding process in a properly constructed mill. A small stream of water is caused to flow on the upper surface of the rasp or grinder, to keep it clean of accumulation of pulp. From the grinder the pulp falls into a washing machine, through which the farina is forced by revolving brushes, the coarser pulp being thrown out at lateral openings. The granules of farina pass into a trough, and are conducted to vats, where the farina is permitted to deposit. After the proper number of filtrations, and depositions have occurred, until the last deposit, which is pure white farina, the latter becomes of sufficient consistency to cut into lumps, and place, either unsupported or in conical wire cases, to dry. The drying process can be accomplished in a building supplied with shelves, and capable of being heated from 60°, at which the farina begins to dry, up to 212°, which is as high a temperature as it will require. The heating apparatus may be such as is most convenient. In Europe the farina is packed in 200 to 212 pound fine sacks, but flour barrels are said to be preferable, as the wood protects it from damage, and allows it to be transported safely to the most distant regions.—*The Journal of Applied Science.*

Animal Tar.

Not many years ago the substance known as coal tar was regarded by chemists as well as by laymen in the light of an uninviting and almost hopelessly complex mixture. To-day, as is well known, it is the source of a large group of highly interesting bodies, and forms the basis of many important industries, some of which are still in their infancy. Certain recent developments in connection with animal tar seem to indicate that there is a future in store for this substance as interesting and as important as the present of coal tar. It is obtained in largest quantity as a secondary product in factories in which boneblack is made by dry distillation of bones and other animal material. By fractional distillation the tar can be divided into several distinct portions, among which are the bases known as pyridine, C_5H_5N, and picoline, C_6H_7N, which are the first two members of a homologous series. Now, through the researches of Dewar, Ramsay, Weidel, Hofmann, and others, it has been shown that these bases are intimately connected with such alkaloids as quinine, cinchonine, cinchonidine, berberine, piperine, and nicotine. All of these alkaloids when oxidized yield acids which are simple derivatives of pyridine or some other member of the series. The chemistry of the alkaloids is then, in all probability, to be discovered through a careful study of the bases of the pyridine series, and this probability has of late led a number of workers to turn their attention to these bases. It can fairly be prophesied that at no distant time our knowledge of the alkaloids will be materially increased through the aid of investigations now in progress.—*Amer. Chem. Journal.*

Glucose for Confectionery.

The *Confectioner's Journal*, in regard to glucose and its enormous product in this country, says: At first it was affirmed that the sugar made from corn was injurious. The learned chemists decided that it was perfectly harmless. The consequence is that vast quantities are now made and sold. Besides a great establishment in New York, there is another in Buffalo, another in Chicago, and several minor establishments in other cities. One of these great establishments used five million bushels of corn in the year 1878.

Confectioners are using great quantities of glucose sugar, because from its uncrystallizable quality it tends greatly to keep certain classes of goods soft for a greater length of time, and retards granulation in other kinds, and because it saves greatly in the cost of all articles with which it is combined.

It was proved before the Congressional Investigating Committees that vast quantities of glucose or corn-starch sugar were sold to sugar refiners; also, that it is sold in great quantities to confectioners. Glucose is now largely used in mixing with California honey, one gallon of glucose to one of honey. It is also used largely in the Eastern States in the manufacture of all sweet wines, lager beer, and all liquors requiring sirups. In fact, corn sugar is now used for all the various purposes for which any sugar is used, except for first-class confectionery. Glucose is also shipped in large quantities to Europe, where it is in great demand and in increasing quantities.

The Steamer Louisiana.

The new steamer Louisiana, of the Cromwell Line, is provided with engines said to possess the largest stroke of any direct-acting engines in the world; they are fitted with balance poppet valves, adjustable cut-offs on both high and low pressure cylinders. The high pressure cylinders having direct connection with one end of the working beam, which is located athwartships, the low pressure cylinder having connection with the opposite end. The engines work well. With eighty pounds pressure of steam they work up to sixty revolutions a minute. The propeller is 17 feet in diameter, and has 27 feet pitch. There are eight patent boilers, of Baird's make, and it is anticipated that the vessel will be a very fast one, as on her trial trip she averaged ten knots an hour with only four boilers at work. The steamer has two iron masts, and on each a "leg of mutton sail" is bent; she carries a jib and foresail and two skysails. The hull is divided by seven watertight bulkheads, which extend to the main deck, and four partial bulkheads. The main and lower decks are entirely of iron. Above is the hurricane or spar deck, on which are situated the wheelhouse filled with steam steering apparatus and the cabins of the captain and other officers. On the main deck is a house which extends from the forehatch to the stern, in which is situated the saloon.

The Louisiana was built by Roach & Son, of plates of extraordinary strength and thickness, the machinery being constructed by C. H. Delamater & Co., of this city. She will carry 100 first and second class passengers, and it is expected that 9,000 bales of cotton can easily be stowed in her hold.

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The Hayden Trial.

Further expert testimony has recently been put in by the defense at the Hayden trial, and has furnished statements of considerable interest. In our previous comments on this trial, we mentioned that the three principal points upon which the testimony bore were: The symptoms and signs which may be produced by the presence of a small ovarian cyst; the tests for blood; and the possibility of distinguishing different samples of arsenic, by the proportion of crystals to amorphous particles seen under the microscope.

The victim, Mary Stannard, was found to have a small ovarian cyst, about three fourths of an inch in diameter. It was claimed by the prosecution that this had given rise to symptoms of pregnancy, and that she had been killed by the defendant in order to avoid the public exposure which her supposed pregnancy would cause.

It will at once appear that the idea of a cyst, so small in size, producing symptoms of pregnancy, can only be characterized as absurd. It cannot perhaps, be absolutely denied that such a tumor may produce some symptoms, since few things can be absolutely denied in medicine. But that such remote possibility of some ovarian irritation should be taken as the basis of a theory of prosecution, shows alike a poverty of theories and of medical knowledge. Such tumors are not very unfrequently found at the post-mortem table, no evidence of their presence having previously been given. They are even found before the age of puberty, and may sometimes remain stationary and undeveloped. The ingenuity of an imaginative legal mind may make it appear probable to the jury, that because the young woman had a small cyst, therefore she had the symptoms of pregnancy; but we do not see how they secured medical experts to help them along. She might have been hysterical, she might have been an excellent case for a gynecologist and a medicated pessary; but she could only by the rarest coincidence have furnished the signs of pregnancy. To this effect the experts for the defense testified.

The counter testimony, in regard to the detection of various samples of arsenic, was not very extended. It was asserted that, owing to peculiarities in the grinding of arsenic, the same manufactory might send out lots in which the proportion of crystals would vary On the whole it seems likely that, as we have stated before, the determination of the source of arsenic by its microscopical appearance can rarely be a certain one. The value of the discovery, therefore, of a varying proportion of crystals in different lots, must, from a medico-legal point, be quite limited.

The question of the tests for blood was testified upon at considerable length. The experts secured for the defense were unanimously positive that human blood could only be distinguished from that of certain other mammals under rare and very favorable conditions, if at all. This was in direct contradiction to the evidence for the prosecution. Dr. Woodward testified that the size of human blood corpuscles in different persons was as variable as that of the individual; and that the size also varied greatly even in the same animal. The range was said to be greater in disease and in the young. This variability applied not only to man, but the lower mammals. It would take, said the witness, forty-two years to find the true average size of the corpuscles of any animal. Alluding to the history of such measurements, the great variance of opinions during different periods was shown. Thus Gulliver, in 1848, made the average size 1-3200 of an inch. In 1864 the average size was found to be 1-3000 to 1-3100 of an inch. The most recent authoritative measurements made the average diameter 1-3620 of an inch. Dr. Woodward took, in general, a very pessimistic view of micrometry. His statements are, however, to some extent misleading. When it was first undertaken to measure blood corpuscles there was no accurate and definite standard for the micrometers; nor is it until recently that this lack of a definite standard has been overcome.

The variation in measurements, therefore, by different observers, may indicate variation in micrometers rather than in the corpuscles. An examination of the different sets of measurements will show a substantial agreement as to the relative size of human corpuscles compared with that of other animals. The statements concerning the great variability in the size of the blood corpuscle are not in accordance with those of the majority of microscopists. Physiologists state that the red blood corpuscle varies less in size than other anatomical elements. Kölliker asserts that ninety-five per cent are of the same size. It is generally agreed that man's red blood corpuscles are larger than those of any of the ordinary domestic animals from which distinction has generally to be made.

In the present case the defendant testified that he had killed chickens with the knife in whose notch corpuscles were found. Since it would be comparatively easy to distinguish the oval corpuscles of the fowl, we were inclined to lay some weight on the testimony of the experts for the prosecution. The impression given by Dr. Woodward as to the exceeding vagueness and inaccuracy of microscopic measurements was unjustifiably strong.

The possibility of distinguishing, under proper conditions, the human blood from that of other animals, cannot be denied. The possibility of being able to do it, however, in any particular case with sufficient certainty to swear away a life, is another thing entirely, and the one in which we do not believe. In the present case, although the scalpel discovered an ovarian tumor, and the microscope arsenical crystals, and possibly human blood, there was nothing established by the expert testimony strong enough to warrant a verdict of guilty.—*Medical Record.*

How to Keep Teeth Clean and Healthful.

As I am not aware of anything practically new in the way of dentifrices, I can only allude to them as auxiliaries or assistants in promoting cleanliness, and in neutralizing the abnormal acidity so commonly present in the oral cavity. No one has yet discovered the magic prophylactic, notwithstanding the absurd claims of tho venders of various nostrums, such as "Sozodont." Of this article I will testify to what is also well known by most dentists, namely, that it destroys the color of the teeth, turning them to a decidedly dark yellow.

There is, of course, quite a general use of tooth brushes by the people, but not uncommonly an abuse of them for want of proper instruction. It is getting to be better understood by both dentists and patients now than formerly that a crosswise brushing is not wise, but that the upper teeth should be brushed downward, and the lower teeth upward. It is a common mistake not to brush thoroughly the buccal and posterior surfaces of the third molars, and the lingual surfaces of the lower front teeth. I am sure that nothing like an adequate amount of care is given to this preventive service. It cannot be too strongly impressed on the minds of the guardians of children that they should see that the practice of brushing the teeth thoroughly is begun as early as possible, so that it shall become a habit to be continued through life.

Concerning the forms of brushes, I will say that straight brushes are utterly impracticable on the surfaces to which I have referred as the ones most neglected. Curved brushes with a tuft end, bud-shaped or convex, are the best. There are several favored forms that are quite efficient in the line I have spoken of. One of these, named the "Windsor," I have faithfully tried for twenty months past, and introduced it very generally in my practice, and I feel that it meets the indications better than any other within my knowledge. The faithful use of floss silk between the teeth ought to be earnestly recommended; also the *quill* toothpick. The wood toothpicks so generally furnished at public eating places are a source of much evil to the soft tissues between the teeth. All kinds of metallic toothpicks are objectionable, though I am aware that it is the practice of some dentists to commend them to their patients.

The value of a decided polished surface of the tooth becomes very apparent to those who have had the operation performed; the facility with which such teeth can be kept clean is evident; and although this condition may have been secured at considerable expense, yet it is an investment that will pay a good rate of interest. I do not think many dentists have much idea of the beautiful polish that a human tooth will take. Many teeth are capable of a great improvement in this direction which are now a decided detriment to what might otherwise be a pleasing face. We know that the general idea among the people is, that interfering with the surfaces of the teeth destroys the enamel, but we also know that this is a popular error.—*G. A. Mills. in Dental Cosmos.*

Infectious Diseases among Live Stock.

Arguing in favor of general legislation with regard to infectious diseases among horses, cattle, sheep, and swine, Mr. Le Fevre said in Congress recently: We have today at least 100,000,000 head of the four principal classes of farm stock named above. If we average these at the low sum of $3 per head we have a money value of $300,000,000. These animals are all subject to deadly contagious and infectious diseases, and unless some general protective law can be passed, the increase of loss to the farming community must increase at an alarming ratio with each recurring year. An eminent veterinarian, in summing up the losses occasioned by the ravages of pleuro-pneumonia among cattle in Europe, says that England imported lung fever of cattle in 1842, just one year before it was brought to the United States, where it has continued up to the present time. Up to 1869 it is estimated that Great Britain had lost, almost exclusively from this disease, 5,549,780 head of cattle, worth £83,616,854, or, say, $400,000,000. For the succeeding nine years, up to 1878, the losses have been equally as heavy, making a total loss of perhaps $500,000,000 in deaths alone, without counting the contingent expenses of deteriorated health, loss of markets, progeny, crops, disinfection, quarantine, etc. And yet England has a contagious disease (animals) act. What might have been the losses from this one isolated disease had it not been surrounded with all the safeguards of a law drawn with the greatest care and carried out with the strictest fidelity?

About twenty-five years ago a disease made its appearance among hogs in some of the great hog-growing States of the West. It attracted but little attention at first, but as it continued to spread from one State to another, and seemed to become more fatal with every recurring year, farmers and stock-growers, and occasionally a physician and surgeon, would devote a little attention to a cursory investigation of the malady, but no definite results were obtained until very recently—not until congress made an appropriation to commence and carry forward an investigation which should result in revealing the true nature and cause of this disease. The investigation has not yet been completed, but the infectious and contagious character of swine plague has been determined beyond question. For several years past the losses from this disease have been estimated at from $20,000,000 to $25,000,000 per annum. The disease has prevailed in this country for near a quarter of a century, and if we place the annual losses during the past decade at $15,000,000 per annum, we have a total loss, sustained principally by the farmers of the country, of $150,000,000. For the other fifteen years of the comparative infancy of the disease the losses no doubt amounted to as much more, making the total loss from this one disease of $300,000,000.

New Coloring Matters.

The new acid green, we learn, can be used for wool by dyeing with oxalic acid in the dye bath. On cotton it is dyed by mordanting first with sumac over night, then passing through tartar emetic, and dyeing in a tepid bath with the necessary amount of coloring matter. On calico it is printed with tannic acid or sumac extract, like methyl green; it is then steamed and, we understand, passed through tartar emetic. The acid green has the advantage that it does not run in steaming if used in connection with picric acid, a fact of great importance in printing; and furthermore, it resists the action of the heat without losing its shade. To print on wool, take 2½ gallons boiling water for 1 lb. green; filter and add 2½ gallons gum water and 3 lb. glycerine.

The Austrian firm, Przybran & Co., patented some time ago the production of a sulpho derivative of alizarine and purpurine, under the name of *alizarin carmine*, which they have now introduced into the market. The new coloring matter is used for dyeing wool, and is recommended as a substitute for madder in all its applications for wool dyeing. It is said to give nicer and purer shades. The alizarin carmine dyes wool of a red color when the latter is mordanted with tin crystals or alum. The sulpho-acids form salts with different bases. The alum salt can be used direct for dyeing wool; however, it is better to use the soda salt on previously mordanted wool by adding tartar to the bath. Different shades are obtained with different mordants.

We see in a foreign contemporary that the firm of Guinon, Jne. & Picard, in Lyon, have lately brought out a product under the name of hematine (*hæmateine*) a derivative of logwood. Hemateine ($C_{16}H_{12}O_6$) is formed from the chromogen of logwood, or hæmatoxyline ($C_{16}H_{14}O_4+3H_2O$) by treating it with ammonia. By this reaction hemateine-ammonia is formed, which gives hemateine either by evaporation in vacuo, or by boiling with acetic acid. Hemateine forms in this case a brownish red, and almost black precipitate, which assumes when dry a greenish metallic appearance like that of some of the anilin colors. When sharply ground and passed through a sieve it takes a redder coloration. It is soluble in water, alcohol, and ether. Hæmatoxyline is with hæmateine the coloring substance of a solution of logwood, which contains as well all the soluble substance of the dyewood. Hæmatoxyline gives with ammonia, hæmatein; the latter is also formed by sprinkling logwood with urin and by fermentation. The product has already been known for a considerable time; its cost, however, was so high that it precluded its application in dyeing, but the above firm have discovered a process by means of which the hæmateine is obtained much more cheaply than hitherto, and the product has already found its way into the dye houses of France, Switzerland, and Austria to such an extent that 2,000 kilos are daily produced in the works of Messrs. Guion, Jne. & Picard, and they are making alterations in order to more than double their output. The brownish black product is completely soluble in water like logwood; it dyes blue blacks, and does not rub off; 15 kilos hæmateine are said to be equal to 100 kilos best logwood, over which it is said to possess great advantages, as well as over logwood extracts.

CAULINE.—Messrs. Savigny & Collineaux have exposed, in an Exhibition of Science as applied to Industry in Paris, samples of

Cauline (the dye from cabbage) in powder, for solution in the dye bath, and as violet, lilacs, blue and green lakes, and as cauline black for leather dyeing. The two coloring matters, *alneine* and *ericine*, we alluded to in our October issue, have also been exhibited in powder, solution, and in paste; the latter also as dry lakes for calico printers and paper stainers.

The *alneine* can be employed instead of cachou in all its applications. On silk, wool, cotton, and jute it is said to give brown, salmon, and mouse gray shades, which are especially beautiful on jute; the shades are of great brightness and solidity, resisting chlorine and any amount of washing.

Cauline, which is extracted from red cabbage, is prepared dry or in sirupy extracts. On wool grayish colors are obtained, varying from silver grays to dark slate. Grayish and gray lilacs, as well as moss greens, can be obtained by cauline without the aid of any other dyestuff. Every metallic salt gives a different but constant shade with cauline, so that by using different mordants several shades can be obtained by dyeing in the same bath, and this latter can be kept and used for a considerable time. Wool dyed with cauline has great affinity for indigo, and very dark blues can be obtained by first dyeing with it, and then adding carmine of indigo to the bath.

On cotton the mordants used for wool give exactly the same shades when used with cauline, a fact of great importance in dyeing mixed goods. Used alone, it gives on cotton a violet and a peculiar blue shade, called cauline blue. For furniture articles, those of jute especially, it is reported that the three coloring matters we have described will be found of very great advantage either for dyeing or printing.

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Further, from cauline a black extract can be produced, which dyes leather blue black. Besides these coloring matters, Messrs. Savigny & Collineaux exhibited at the same time a great variety of tasteful patterns dyed with their new products.—*Textile Manufacturer.*

Precautions against Photographic Forgeries.

Recently a number of London banks have printed in color on their checks their names in microscopic characters, repeated over and over so as to form a sort of pattern. The object of this microscopic printing is twofold. The erasing of a word or figure upon a surface of small print of this kind cannot be done without erasing some of the tiny words as well, and as these obviously cannot be restored, there is no way of covering up such erasure; in the second place the printing in color of such tiny letters is deemed sufficient to baffle any attempt to copy a check by means of photography. No doubt the bank authorities are right in their conjecture that it would be impossible to secure a copy of one of their checks before the camera, printed as the document now is; but for all that, the *Photographic News* deliberately expresses the opinion that a check of this kind is not nearly so safe as the finely executed checks in plain black and white of the Bank of England. Proof of this assertion is found in the recent successful use of photography in France in imitating colored checks. Even the blue notes of the Bank of France have not escaped these *chevaliers de l'industrie;* and it is but a year or two ago that the French police were enabled to make a seizure

Just after the Franco-German war, when bank notes were exceedingly prolific with the French, there were large numbers of the spurious blue notes in circulation; and on the principle of setting a thief to catch a thief, the Direction of the Bank of France at once invoked the aid of photography to detect photographic forgeries. M. Gobert, a well known member of the French Photographic Society, and an accomplished photographic chemist, was retained by the Bank of France as adviser, and it is in a great measure due to him that abatement of photographic forgeries in France is due. Many years ago Mr. Spiller was called in as scientific referee in the matter of color printing upon checks, and gave much excellent advice upon this subject; but, unfortunately, English banks do not keep pace with the times, and what was impossible twenty years ago, is perfectly feasible at the present moment.

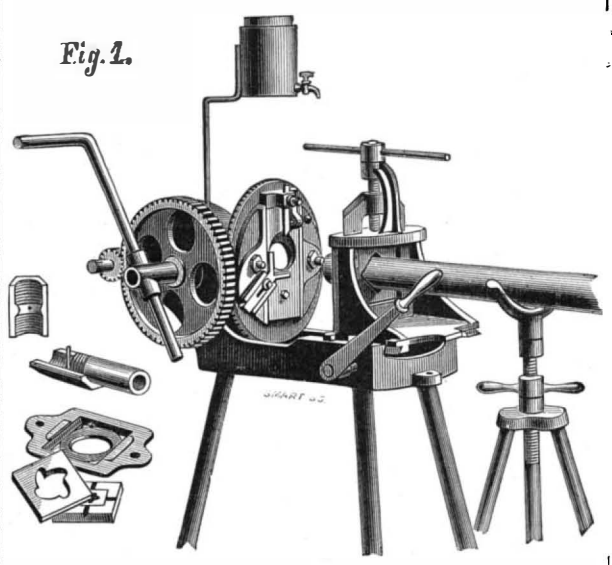
The German authorities used to consider that they had altogether defied imitation by having recourse to very fine printing at the back of their bank notes—similar to that on the checks of the Check Bank, London and Westminster, London and County, etc.—this fine printing, which was in black, setting forth the severe penalties which would be visited upon those who endeavored to forge such documents. This fine print, rather than acting as a barrier, resolved itself rather into a premium for copying by photography. The bank note was put under a microscope or magnifier, and the tiny printing thus enlarged, it could then be imitated by an engraver, and the photographer had simply to photograph the copy in order to produce the small printing. And so, the *News* is inclined to believe, the microscopic printing in color, rather than acting as a safeguard against the production of spurious checks, will render the matter somewhat more easy. The color—whether it is applied as a simple tint, or in the form of microscopic words—serves the purpose in a forgery of covering up defects in the engraving of the check. Rather, therefore, than adding to the difficulty of copying, it rather lightens it, since the work not being in pure black and white need not be so faultlessly executed. This is why the blue applied to the Bank of France was no protection.

Photographers, nowadays, know a good deal about the sensitiveness of various collodion films for different colors, and are also well versed in what may be done by under-exposure and over-intensifying, and *vice versa*, and there are few tints or designs that they cannot copy one way or another; and by having recourse to combination printing, a skilled operator will overcome the most stubborn opportunities. But there would be no need, of course, in order to imitate a modern check to copy the minute blue or pink printing upon them. This would be produced of large size; a reduced negative, executed with the type of proper dimensions, and impressed upon a colloid film, would be capable of yielding any number of impressions and in any color; while as to fineness of the type and freedom from blurring, the result would simply be more perfect than the majority of checks with which the public deal. Any one who has seen the fine details of a map reproduced upon a colloid film, the delicate shading and minute lines, will readily believe this, while we may point out that scarcely less perfect work is produced nowadays by a phototype process. The finely executed drawings we see upon the *Graphic Programme* and other theatrical publications, which are as delicate as anything done by engraving, are all prepared by the aid of photography, the original sketches, in the first instance, being produced many inches high. The lines are fine and black in the originals, and in the course of reduction become, of course, exceedingly delicate; thus it is that the drawings appear so refined beside an ordinary woodcut. These facts are recited to show how the graphic arts have improved of late by the aid of photography, and to point out that what might have been impossible some years ago is perfectly possible at the present day; and to this fact the bank authorities should give attention. Certainly, microscopic printing in colors cannot be relied upon at the present moment as a safeguard against the forging of checks; for a skilled hand would have more difficulty in counterfeiting the black and white document issued by the Bank of England than one in which a combination of colors is to be found.

A LABOR-SAVING TOOL.

The annexed engraving represents a very effective and simple pipe cutting and threading tool manufactured by the Chase Machine Company, New York city. This invention enables the workman to perform with ease one of the most tedious and laborious operations in mechanics, and it does its work expeditiously and perfectly. It is capable of cutting regular chips in the same manner as a lathe, leaving the work smooth and perfect. It will form a thread on all sizes of pipe from ¼ inch to 2 inches inclusive. To steam fitters, gas fitters, and machinists it will prove of great value, and car shops, steamers, sugar refineries, distilleries, should be furnished with these machines. Wherever it is required to thread pipes or bolts, or to tap nuts, this machine will be found efficient and satisfactory. The machine is capable of making nipples, and is provided with an automatic cut-off. In its construction it is very strong and well adapted to the work for which it is intended. All the gears are cut and it is well finished in every part. It may be

Fig. 1.



CHASE'S PIPE CUTTING AND THREADING MACHINE.

worked by hand or by any convenient power, and it may be readily adapted to different kinds of work. It will operate equally well on wrought iron gas and steam pipes, boiler tubes, oil well tubes, brass and copper tubes, rods, bolts, etc. For further particulars, address The Chase Machine Company, No. 120 Front St., New York city.

Torpedo Investigations.

Brevet Brigadier General H. L. Abbot read a paper on "The School of Submarine Mining at Willett's Point" at the recent meeting of the United States Military Service Institution on Governor's Island. The paper contained the following information of general interest:

The first subject of study was to secure the best explosives for submarine warfare, and types of all explosives known to science were used with the result of finding the best for the service to be dynamite, consisting of 75 per cent of glycerine and 25 per cent of Keiselguhr. The element of time proved to be one of extraordinary importance with explosive compounds. Nitroglycerine under water develops but about eight tenths the intensity of No. 1 dynamite. The interposition of a wooden case between the charge and the water was found to greatly reduce the kinematic energy available. In order to discover the laws of transmission of a shock horizontally through water a wrought iron frame was used, and the charge secured at the central part, and gauges placed symmetrically with respect to a horizontal plane passing through it were secured at angles between the transverse frames. The results proved that the same formula can be used for all modern explosives by substituting the right numerical value for one constant. By this the relative value of explosive compounds can be fixed and the intensity of action computed. To learn completely the destructive range for subaqueous explosions, it was necessary to learn the intensity of action needful to destroy a first class ship of war. For this purpose an iron target twenty feet square was used to represent the bottom of a vessel made on the double cellular principle; and a numerical value for the intensity of action needed was found. From English tests. by aid of the previously mentioned formula, a second value of this element was reached, and some trials on a very strong wooden raft gave a third value. The three were so accordant that the value adopted by the Board of Engineers is satisfactory, and the size and range of the charge have been accordingly fixed.

The three essential conditions of a torpedo are endurance in sea water, power to resist shocks of explosions in the vicinity, and strength to resist the blows of friendly vessels in passing. Experiments to secure these objects have been carried on for six years, and a torpedo has been adopted finally which is believed to be superior to any abroad. Ground torpedoes are cast iron spheres resting on the bottom on their truncated base. Buoyant torpedoes are spheres of steel of a size suited to the strength of the current. For firing mines the active agent is electricity. The subject of the fuse has been exhaustively studied and new methods of research undertaken. Over eighty patterns of foreign and domestic varieties have been compared and are now in the museum at Willett's Point. The one finally adopted retains its action after years in a torpedo and is absolutely certain.

For the operation of mines a very superior system has been adopted and is kept secret. It allows the safe passage of friendly vessels, and causes explosions when struck by the enemy; or any one can be fired, every part can be tested, and an injury determined. In important harbors the electric light will be used in the system of defense. The form of lens adopted throws a concentrated light to any desired spot, but its use is impaired when the air is rendered opaque by moisture or smoke, as the particles in the air are brightly illuminated and form a screen to hide the object. Experiments with fish torpedoes have also been made, and one recently tried showed excellent results. The control of the fish was perfect, as it could be stopped, started, or turned in any direction.

The New System of Signaling at Sea.

The following system of ocean and river signaling has been agreed to by the governments of Great Britain, France, Germany, Russia, Italy, Spain, Portugal, Belgium, Denmark, Sweden, Netherlands, Austro-Hungary, Greece, Chili, and the United States of America. Besides the usual colored lights, a steamer discerning another steamer or sailing vessel in sight has to sound with the steam whistle or fog horn a short blast, which will mean "I am directing my course to starboard;" two short blasts will signify "I am directing my course to port," and three short blasts, "I am going full speed astern." In fog, mist, or falling snow the signals are to be repeated every two minutes, a prolonged blast indicating that the vessel is under way; an ordinary blast, that the vessel from which it proceeds is on the starboard tack; two blasts in succession, "I am on the port tack;" and three blasts in succession, the wind abaft the beam. A vessel in fog, not under way, has to ring the bell every two minutes. Concurrent with the foregoing are ocean signals. The Thames Conservancy are issuing rules of road, which are to take effect on British and foreign ships entering the River Thames. Where steamers are proceeding one up and one down the river, involving a risk of collision, they are to pass port side to port side. If there be no risk of collision they will both keep their course and pass either starboard side to starboard side or port side to port side. In rounding a point, like that where the Princess Alice collision occurred, the steamer going against the tide is to wait under the point until the vessel going with the tide has passed clear. Where a steamer and a sailing vessel are proceeding in a direction likely to involve a collision, the steamer has to slacken speed to keep out of the way of the sailing vessel and let the latter pursue her course. If the steamer cannot possibly or safely get out of the way she is to blow four blasts and slacken speed, and the sailing vessel is to keep out of the steamer's way.

Influence of Plants on the Products of the Dairy.

The Agricultural Museum, of Berlin, lately exhibited at the Dairy Exhibition a collection of plants which may influence the different products of the dairy. The catalogue gave the following list:

1. Plants which coagulate milk: the milky juice of the fruit of *Aspidosperma quebracho*, Lor., used in the Argentine Republic; the milky juice of the unripe fruit of *Carica papaya*, L., Papaw tree; *Cirsium arvense*, Lam., Canada thistle; *Cynara cardunculus*, L., Chardoon; *Ficus carica*, L., Fig; *Oxalis acetosella*, L., Wood sorrel; *Piper nigrum*, L., Black Pepper; *Quercus infectoria*, Oliv., Gall Oak; *Rumex patientia*, L., Garden Patience.

2. Plants which prevent the coagulation of milk: *Cochlearia armoracia*, L., Horseradish; *Pinguicula vulgaris*, L., Common Butterwort; *Sanicula Europœa*, L., Wood Sanicle.

3. Plants which are used to color butter and cheese: *Bixa orellana*, L., Annatto; *Calendula officinalis*, L., Marigold; *Carthamus tinctorius*, L., Safflower; *Crocus sativus*, L., Saffron; *Curcuma longa*, L., Turmeric; *Crozophora tinctoria*, Ad. Juss., Turnsol; *Daucus carota*, L., Carrot; *Morus tinctoria*, L., Fustic. [Also *Galium verum*, L., Cheese-renning Bedstraw, or Yellow Bedstraw.

4. Plants which are used to flavor cheese: *Melilotus cœrulea*, L., Blue Melilot; *Penicillum glaucum*, Lk., Blue Penicillum.

5. Plants used to prevent rancidity in butter: *Rumex Abyssinicus*, Hochst., Abyssinian Sorrel.

6. Plants which impart to milk a peculiar color, after being eaten by cows: (*a.*) reddish: *Galium verum*, L., Yellow Bedstraw; *Rubia tinctorum*, L., Madder. The same is said of species of *Carex, Scirpus, Equisetum, Ranunculus, Euphorbia*, and of young twigs of pine, etc. (*b.*) yellowish: *Daucus carota*, L., Carrot; *Rheum palmatum*, L., Rhubarb. (*c.*) blue: *Anchusa officinalis*, L., and *A. tinctoria*, L., Alkanet; *Butomus umbellatus*, L., Water Violet; *Melampyrum arvense*, L., Purple Cow-wheat; *Mercurialis perennis*, L., Perennial Mercury; *Polygonum aviculare*, L., Common Knot Grass; *Polygonum Fagopyrum*, L., Buckwheat; *Rhinanthus major*, L., Yellow Rattle.

7. Plants which impart a peculiar, often acrid taste to milk: *Allium ursinum*, L., Ramsons; *Artemisia absinthium*, L., Wormwood; *Brassica napus*, L., Rape; *Brassica rapa*, L., Wild Turnip; *Euphorbia cyparissias*, L., Cypress Spurge; *Gratiola officinalis*, L., Hedge Hyssop; *Helleborus niger*, L., Black Hellebore; *Matricaria Chamomilla*, L., German Chamomile; *Zea mays*, L., Maize; —*From Industrie Blätter.—New Remedies.*

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Wanted—A Manganese Property. Address Fuller & Stillman, 40 Broadway, New York.

A Machinist and Inventor desires a situation where inventive and constructive ability would be serviceable. Models designed and constructed, or inventors assisted in working out ideas. Address R. Williams, 43 Fourth St., Brooklyn, E. D., N. Y.

Models made to order. H. B. Morris, Ithaca, N. Y.

For Sale.—About 4 tons fine Corundum; from No. 160 to dust. The J. Morton Poole Co., Wilmington, Del.

For Pat. Safety Elevators, Hoisting Engines and Machines, Friction Clutch Pulleys, and Cut-off Coupling, see ad. p. 61.

To Fertilizer Manufacturers.—A chemist experienced in this line is open to a two months' engagement. Will furnish apparatus and chemicals. Address F.C.B., P.O. Box 773, New York city.

Wanted.—A Second-hand Turbine Wheel. Give price and dimensions. Address E. L. Pemberton, Fayetteville, N. C.

The "Fitchburg" Automatic Cut-off Horizontal Engines. The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

The steam pipes, boilers, etc., of the Delamater Iron Works, Burdon Iron Works, and the Municipal Gas Company, are protected with H. W. Johns' Asbestos Boiler Coverings. H. W. Johns Manufacturing Company, No. 87 Maiden Lane, New York, sole manufacturers of genuine Asbestos Liquid Paints, Roofing, etc.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., etc., sent post free on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Rundell's Mower and Patterns will be sold, or licensed to manufacture on royalty, to the highest bidder. The sale will be closed March 16, 1880. Pat. Oct. 21, 1879. For further information, inquire or visit the inventor, Wm. F. Rundell, Genoa, Cayuga Co., N. Y.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Launches and Engines. S. E. Harthan, Worcester, Mass.

Special Wood-Working Machinery of every variety Levi Houston, Montgomery, Pa. See ad. page 45.

Brick Presses for Fire and Red Brick. 309 S. Fifth St., Phila., Pa. S. P. Miller & Son.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 45.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Eclipse Portable Engine. See illustrated adv., p. 30.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 9 cents per pound. Fully warranted.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 62.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Emery Wheels of all kinds, and Machines at reduced prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 333.

Patent Steam Cranes. See illus. adv., page 62.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

$400 Vertical Engine, 30 H. P. See page 62.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 61.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 61.

For Machine Knives and Parallel Vises, see advertisement, p. 61. Taylor, Stiles & Co., Riegelsville, N. J.

The Twiss Automatic Cut-off; also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

NEW BOOKS AND PUBLICATIONS.

BLOWPIPE ANALYSIS. By J. Landaur. Translated by James Taylor and William E. Kay. London: Macmillan & Co. 12mo, pp. 161. Price $1.50.

Differs from the usual run of works on blowpipe analysis in treating the matter entirely from a chemical point of view. In this way the author has sought to make blowpipe analysis more useful to the chemist without its losing any of its value to the metallurgist and mineralogist. The book is well indexed, and in every way shows the good workmanship characteristic of the house whose imprint it bears.

TREATISE ON FUEL. By Robert Galloway. London: Trübner & Co. pp. 136.

A scientific and practical text book for students in the higher schools and colleges, the subject being wisely kept within narrow limits. The one obvious lack of the book is a good index.

SOME PRACTICAL HINTS ON WOOD ENGRAVING. By W. J. Linton. Boston: Lee & Shepard.

The explanatory line on the title page "for the instruction of reviewers and the public" will prevent any unreasonable expectation from students of the practical art of engraving. As a bit of retaliatory criticism the book is entertaining.

MANUAL OF EXHIBIT BOOKKEEPING, INTRODUCING A SIMPLIFIED METHOD OF KEEPING AND AUDITING ACCOUNTS. By Selden R. Hopkins. New York: The Hopkins Company, publishers.

A work of rare simplicity and practical utility, and as unconventional as it is useful. The system taught is one that any student or business man can easily master and apply, so as to be not only able to tell at all times exactly how his affairs stand, but to do it with much less labor and liability to error than by the more complicated systems of book keeping usually employed.

MEMOIRS OF THE SCIENCE DEPARTMENT, UNIVERSITY OF TOKIO, JAPAN. Vol I., part 1. Shell Mounds of Omori. By Professor Edward S. Morse. Tokio: Published by the University. 1879.

The Omori shell mounds lie on the western side of the Imperial Railway between Yokohama and Tokio, nearly six miles from Tokio and half a mile from the Bay of Yeddo. Like the prehistoric shell mounds in other parts of the world they contain abundant vestiges of the race which anciently inhabited the country, in fragments of human bones, pottery, and implements of bone and stone. Typical forms of a large number of such specimens are figured in the seventeen plates of this memoir. Though of high scientific value this first publication of the University of Tokio has an equally high industrial interest. All the figures were drawn and engraved by Japanese artists, and the composition and press work have been done by Japanese unable to speak English. The paper and binding are also Japanese. That such good work should be done under so many unfavorable conditions is much to the credit of these Yankees of the far East.

AROUND THE WORLD WITH GENERAL GRANT. By John Russell Young. New York: American News Company. 20 parts. Price 50 cents each.

The first five parts of the well written and handsomely illustrated record of travel were noticed some months ago. Parts six to ten finish Europe and carry the party to India. Burmah and Farther India are described in the thirteenth and fourteenth parts. The promise of the early numbers has been admirably fulfilled.

THE MAGAZINE OF ART. New York: Cassell, Petter, Galpin & Co. Price $2.75 a year.

In addition to forty pages of letterpress with many engravings, the December number of this popular magazine contains three full page illustrations as follows. The Casuals, from a painting by Luke Filds, A.R.A.; Christ and Mary Magdalen near the sepulcher, by Albano; and the First Roebuck, by A. Eberle.

ODDMENTS OF ANDEAN DIPLOMACY. By Hinton Rowan Helper. St. Louis: W. S. Brian.

Chiefly devoted to a history of the claim of J. H. Colton against Bolivia for map engraving, and the Fiedler claim against Brazil for charter money for the steamship Circassia engaged in transporting emigrants to Brazil. Incidentally Mr. Helper's main "oddment" is developed, namely a project for an 8,000 mile double track steel railway "from the westerly shores of Hudson Bay to the midway margin of the Strait of Magellan."

DOUBLE STAR OBSERVATION MADE IN 1877-8 AT CHICAGO WITH THE 18½ INCH REFRACTOR OF THE DEARBORN OBSERVATORY. By Sherburne Wesley Burnham, M.A. Reprinted from the Memoirs of the Royal Astronomical Society. Vol. XLIV.

Comprises I., a catalogue of 251 new double stars, with measures. II., micrometrical measures of 500 double stars, making a total of more than 1,400 micrometrical measurements. Many of the new doubles are naked-eye stars, and some of the most interesting class. These observations are the first contribution of the Great Equatorial of the Dearborn Observatory.

TEA CULTURE AS A PROBABLE AMERICAN INDUSTRY. By Wm. Saunders, of the Department of Agriculture. Washington: Government Printing Office.

This special report of the Department of Agriculture contains the valuable paper read by Mr. Saunders before the New York Horticultural Society, last October and duly noticed in the SCIENTIFIC AMERICAN at the time.

BORIES' UNIVERSAL POISON REGISTER. Dayton, Washington Territory: Emil Bories, publisher.

This is a blank book for recording sales of poison by druggists and others. Spaces are provided for entering the name of the poison sold, the quantity, by whom purchased and for whom, the date of sale, the alleged purpose for which the poison is bought, the name of the seller, and the residence of the purchaser. Though intended specially to meet the requirements of the laws of Washington Territory relative to the sale of poison, this record would be convenient and useful for all druggists, and if faithfully kept would have much legal and sanitary value.

BUILDING SAFE GUIDE. By Charles Marcotte, Architect. St. Louis: Slawson & Pierrot. 12mo, paper, pp. 136. Price $1.

Mr. Marcotte has evidently had not a little unpleasant experience with tricky contractors and artisans in the building trade, and gives the world the benefit of his knowledge with the least possible reserve. He claims that his main object is the protection of owners, agents, architects, mechanics, and others engaged in the building trade; and to further this end he gives, in addition to much practical information relative to the safe transaction of building business and the materials and qualities of workship in all the trades connected therewith, a general exposure of the various frauds practiced by dishonest contractors, builders, and mechanics.

HUBBARD'S RIGHT HAND RECORD AND READY REFERENCE FOR LEADING ADVERTISERS. New Edition. New Haven, Conn.: H. P. Hubbard, Newspaper Advertising Agent.

A convenient hand book for advertisers, containing a list of all the periodicals published in the United States and Canada, arranged in order, with population of towns, the circulation of the papers, and blank spaces for recording contracts, estimates, acceptances, etc.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) M. M. L. writes: I have about 6 cells of a battery, of which the outer cup is zinc, and into this fits a porous cup containing an iron core. What is such a battery called, and what fluids are used in it? A. Are you quite sure the core is iron? It should be carbon, and if it is carbon the battery is a modification of Bunsen's, and requires a bichromate solution in the porous cell and dilute sulphuric acid in the jar. See Batteries, in SUPPLEMENTS 157, 158, and 159.

(2) T. A. R. asks if there is any difference between applying an engine in the center, and at one end of a line of shafting 400 feet long? A. When power is applied to one end of a long line of shafting the speed of the machinery driven from the other end will be irregular, owing to the spring of the shaft; for this reason it is better to apply the power to the center of the shaft.

(3) T. E. M. writes: 1. I am investigating the subject of a cheap household motor with power sufficient to drive sewing machine, churn, washing machine, etc. How would compressed air answer the purpose? A. Very well. 2. Could a common wind engine, such as is used on prairies for pumping, be used successfully to compress the air for the above purpose? A. Yes. 3. If so what size would be sufficient? A. This would depend upon the amount of power and the number of hours per day it is used. 4. Are there any air compressors in the market and at what price? A. There are large compressors driven by steam engines, prices according to size. 5. Name a good work on the steam engine, cheap work, for practical engineers. A. "Roper on Land and Marine Engines."

(4) L. P. D. asks: 1. Can the deepest portions of the ocean be sounded? If so, how? A. They have not been sounded; the deepest soundings yet taken was about 4,650 fathoms. 2. Some claim that heavy bodies will not sink in the ocean only to a certain depth, according to their specific gravity. A. Bodies of but little greater specific gravity than water will sink to the bottom.

(5) E. A. B. asks how to paint on silk. A. Stretch the silk over a board or upon a "stretcher" and paint with ordinary water colors.

(6) J. M. S. writes: I notice in SCIENTIFIC AMERICAN, for October 11, 1879, in "Notes and Queries," in answer to H. B., referring to the wear of locomotive cylinders, you say: "Do they wear most at the ends: if so they wear differently from all other steam cylinders." A moment's observation should satisfy you that they do, and that all other steam cylinders do also. Is not the pressure greatest at the ends of the cylinder, and the piston packing tighter at that point than at any other? I have never measured a cylinder that has run any length of time but what I find it largest at the ends. A. In the class of pistons in which the rings are forced outward by steam pressure, it may be true that the wear is greatest at the ends of the cylinder; but in the case of ordinary packing rings, where the pressure and friction are the same throughout the stroke, the wear will be nearly uniform.

(7) C. F. H. asks how he can get on walnut the fine finish like that seen on pianos. Have tried shellac varnish and a polish of two parts shellac and one boiled oil applied with a cloth and rubbed until polish appears. A. Apply the Wilson wood filler; when it becomes dry, give the work two coats of rubbing varnish; when this becomes thoroughly dry and hard, rub down with pumice stone and water, and then with rotten stone and water. Wash the work, allow it to dry, and lastly, apply a coat of fine flowing varnish.

(8) S. V. asks for formula for blacking transits, theodolites, etc. A. Apply to the cleaned brass surface a mixture of 4 parts of hydrochloric acid and 1 part of arsenic (by weight). Wash, dry, and lacquer.

(9) A. H. J. asks: If a cannon ball and a rifle ball be fired from opposite directions and meet on a straight line, and the cannon ball being the heavier and does not cease motion but takes the rifle ball back again, does the rifle ball cease to have motion at the time of meeting? A. Yes; the motion of the rifle ball cannot be reversed, without there being a point in time when it has no motion in either direction.

(10) J. F. A. asks: What would be the proper size engine and wheels for a boat (flat bottom) 50 feet long, 14 feet beam; how many miles per hour would she make? A. With a pair of 9 inch cylinders having 2 feet stroke, and with wheels 10½ feet diameter, the speed would be about 8½ miles per hour.

(11) E. B. asks for information in regard to nickel plating, and wants something that can be applied to iron or steel, and if possible without battery or other apparatus. A. We know of no satisfactory way of plating iron or steel with nickel without electricity. You will find an article on the subject on p. 209, Vol. 38, SCIENTIFIC AMERICAN.

(12) F. H. writes: One telegraph wire, ordinary size, is attached to the house, by means of an ordinary insulator fixed to the window framing. At nearly all times of the day or night I am troubled by a humming noise, more or less loud, but at all times very disagreeable. Is there no simple means of preventing this annoyance? The house stands on the brow of a hill, exposed to the winds, but I have noticed the humming noise is frequently very loud when the air is quiet. What I would like is to find the cause and the cure for the trouble. A. The noise referred to is produced by the vibration of the wires by the wind. A slight and almost imperceptible breeze is sufficient to set the wires in motion. The remedy is to attach to the wire between its supports a string or wire, and attach it to some fixed object. If a wire is used it should of course be insulated.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

F. A. P.—Iron pyrites, sulphide of iron.

COMMUNICATIONS RECEIVED.

Questions for Botanists. By G. A. H.

On the Decrease in the Speed in the Earth's Rotation. By H. F.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 30, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Adz eyes, die and punch for forming, L. Chapman (r) 9,007
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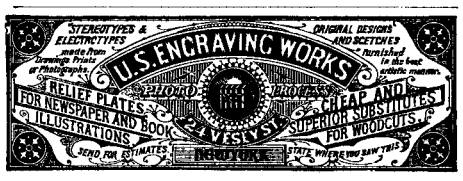
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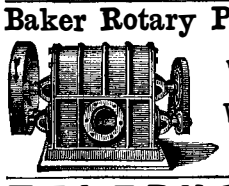

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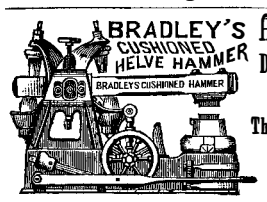

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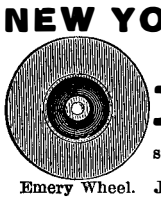

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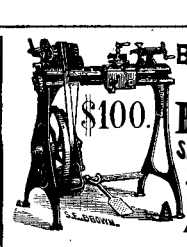

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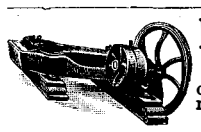

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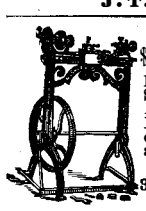

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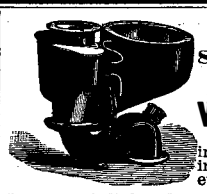

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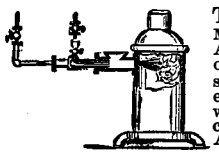

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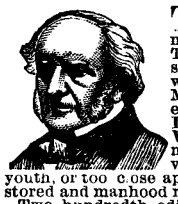

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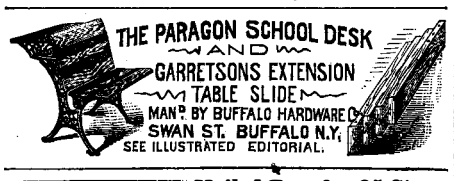

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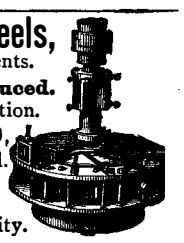

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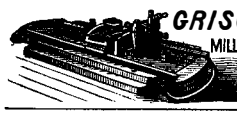

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